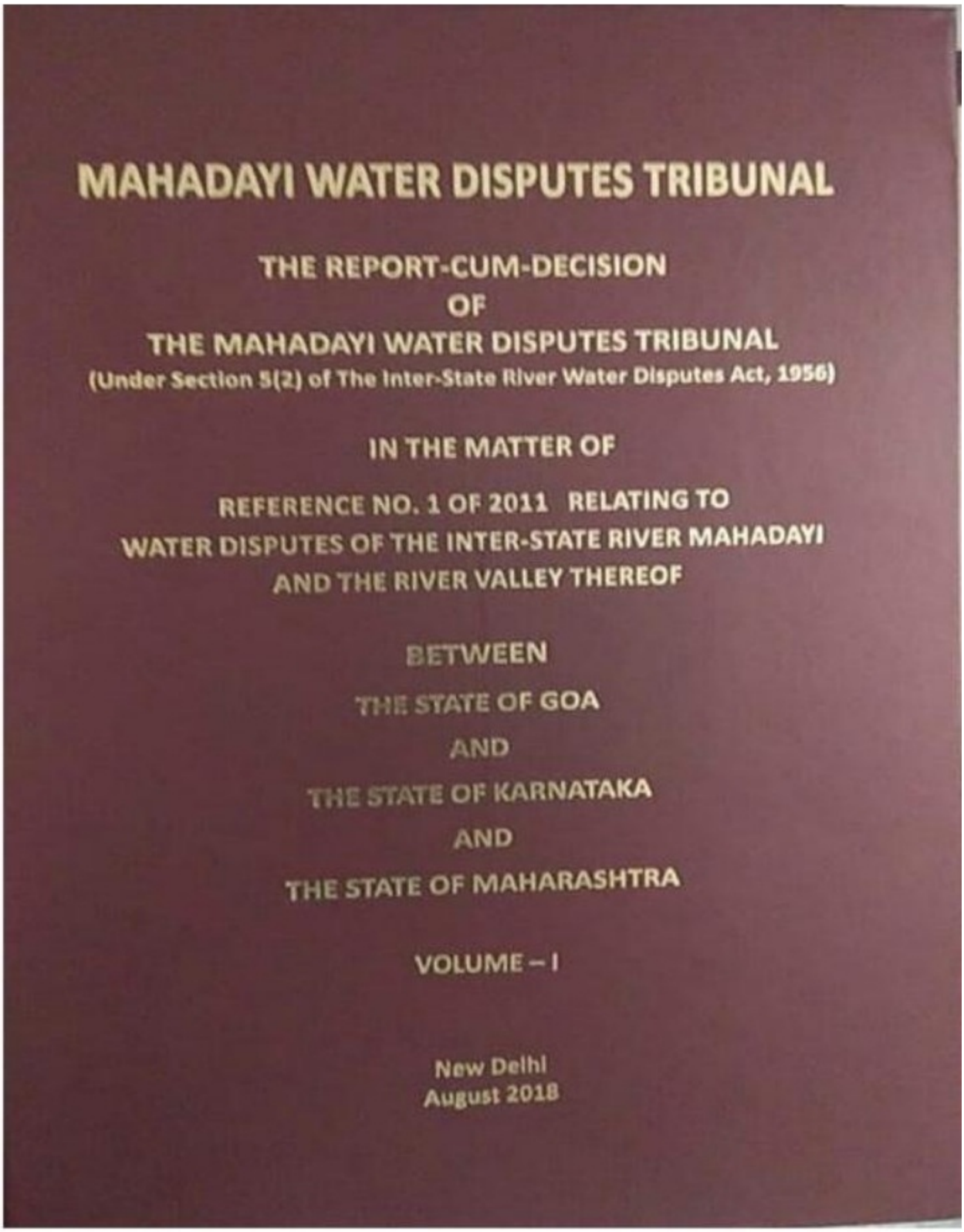
IN HISTORY OF INDEPENDENT INDIA THIS IS ONE OF THE MOST IMPORTANT AWARD BY



AN INTERSTATE WATER DISPUTE TRIBUNAL- IT NEEDS TO BE WIDELY STUDIED AND

DISCUSSED IN WHOLE WORLD-THEREFORE THIS IS AN UNOFFICIAL COMPILATION OF FULL

REPORT BY MAHADAYI BACHAO ABHIYAN GOA – HERE IS COVER PAGE OF PRINTED

REPORT - ALL THE 12 -E- VOLUMES ARE ACCESSIBLE FROM WEBSITE OF MOWRRDGR -

8/16/2018

Mahadayi/Mandovi River | Ministry of Water Resources, River Development & Ganga Rejuvenation | Government of India

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय
MINISTRY OF
WATER RESOURCES, RIVER DEVELOPMENT
& GANGA REJUVENATION

MAHADAYI/MANDOVI RIVER

In July, 2002, the State of Goa made a request under Section 3 of the Inter-State River Water

Disputes Act, 1956 (as amended) for constitution of the Tribunal under the said Act and refer

the matter for adjudication and decision of dispute relating to Mandovi River. The issues

mentioned in the request included the assessment of available utilisable water resources in

the basin at various points and allocation of this water to the 3 basin States keeping in view

priority of the use of water within basin as also to decide the machinery to implement the

decision of the tribunal etc. The Act requires that Central Government shall constitutes a

tribunal if it is of the opinion that water dispute cannot be settled by negotiation.

Therefore, actions and efforts of Central Government in MoWR since July, 2002 were

basically guided by the aforesaid provision of the Act. In continuation of this process, Hon'ble

Union Minister for Water Resources convened an inter-State meeting on 4.4.2006 at the level

of Chief Ministers of the States of Goa, Karnataka and Maharashtra. Subsequent actions of

Government of Goa with regard to follow up action on decisions taken in the inter-State

meeting gave impression that State of Goa is not ready to pursue the negotiation process

further and wants constitution of tribunal and reference of the dispute to the Tribunal

immediately. Accordingly, the Central Government in the MOWR concluded that the dispute

contained in the request of State of Goa of July, 2002 cannot be resolved by negotiation and

initiated further action in the matter as per the provisions of Inter-State River Water Disputes

Act, 1956 and rules made there under.

Meanwhile the Govt. of Goa filed a suit in the Hon'ble Supreme court in Sept, 06 for setting up

of a water dispute tribunal for adjudication of the above river water dispute and an

interlocutory Application (IA) for stay in construction activities. The Writ Petition with the

application has been listed on a number of occasions before the Hon’ble Supreme

Court. Meanwhile, the Cabinet considered in its meeting held on 10.12.2009 and approved

the proposal of constitution of Mahadayi Tribunal.

Cabinet Committee on Accommodation in its meeting dated 06.10.2010 approved proposal of

locating Tribunal in New Delhi.

Central government has constituted Mahadayi Water Disputes Tribunal (MWDT) vide

notification dated 16th November, 2010.

Further, the central Govt. vide notification dt. 13th November, 2014 decided that the effective

dt. Of constitution of MWDT shall be 21st August, 2013 instead of 16th November, 2010.

Accordingly the Tribunal shall forward its report under sub-section (2) of section 5 of the said

8/16/2018

Mahadayi/Mandovi River | Ministry of Water Resources, River Development & Ganga Rejuvenation | Government of India

Act to the Central Govt. within a period of 3 years w.e.f. 21st August, 2013, i.e. on or before

20thAugust, 2016. As per proviso to Section 5(2) of the said Act, the Tribunal has been given

two extensions of one year each viz. extension given for period of one year w.e.f. 21st August,

2016 vide Notification dated 11th August, 2016and extension given for period of one year

w.e.f. 21st August, 2017 vide Notification dated 24th July, 2017. The Tribunal shall forward its

report under Section 5(2) of the ISRWD Act, 1956 on or before 20th August, 2018.

MWDT Report Vol. I MWDT Report Vol. I MWDT Report Vol. I MWDT Report Vol. I
MWDT Report Vol. I



MWDT Report Vol. II MWDT Report Vol. II MWDT Report Vol. II MWDT Report Vol. II
MWDT Report Vol. II



MWDT Report Vol. III MWDT Report Vol. III MWDT Report Vol. III MWDT Report Vol. III
MWDT Report Vol. III



MWDT Report Vol. IV MWDT Report Vol. IV MWDT Report Vol. IV MWDT Report Vol. IV
MWDT Report Vol. IV



MWDT Report Vol. V MWDT Report Vol. V MWDT Report Vol. V MWDT Report Vol. V
MWDT Report Vol. V



MWDT Report Vol. VI MWDT Report Vol. VI MWDT Report Vol. VI MWDT Report Vol. VI
MWDT Report Vol. VI



MWDT Report Vol. VII MWDT Report Vol. VII MWDT Report Vol. VII
MWDT Report Vol. VII MWDT Report Vol. VII



MWDT Report Vol. VIII MWDT Report Vol. VIII MWDT Report Vol. VIII
MWDT Report Vol. VIII MWDT Report Vol. VIII



MWDT Report Vol. IX MWDT Report Vol. IX MWDT Report Vol. IX MWDT Report Vol. IX
MWDT Report Vol. IX



MWDT Report Vol. X MWDT Report Vol. X MWDT Report Vol. X MWDT Report Vol. X
MWDT Report Vol. X



MWDT Report Vol. XI MWDT Report Vol. XI MWDT Report Vol. XI MWDT Report Vol. XI
MWDT Report Vol. XI



MWDT Report Vol. XII MWDT Report Vol. XII MWDT Report Vol. XII
MWDT Report Vol. XII MWDT Report Vol. XII



Order dated 16.08.2018 Order dated 16.08.2018 Order dated 16.08.2018 Order dated 16.08.2018





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MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - I

(V O L U M E S I - XII)

New Delhi

14 th August 2018

COMPOSITION OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

CHAIRMAN

Justice J.M. Panchal

(Former Judge, Supreme Court of India)

Members

Justice Viney Mittal

(Former Judge, High Court of Madhya Pradesh)

Justice P.S. Narayana

(Former Judge, High Court of Andhra Pradesh)

ASSESSORS

1.

Mr. M.E. Haque

Former Member,

(Water Planning and Projects)

Central Water Commission,

Ministry of Water Resources,

Government of India

2.

Mr. Satya Pal Kakran

Former Member/Chairman

Central Water Commission,

Ministry of Water Resources,

Government of India

EXECUTIVE ENGINEER

1.

Mr. Sunil Kumar Sinha

Former Deputy Director,

Central Water Commission,

Ministry of Water Resources,

APPEARANCES

1.

Atmaram N.S. Nadkarni, P.S. Narasimha, Mahesh Sonak, Senior Advocates, Dattaprasad Lawande, Advocate General for the State of Goa, (P. Venugopal, Ms. A. Subhashini, Verenkar Pankaj, N. Laud, V. Madhukar, Rajesh Shivolkar, Ms. Surekha Raman, K. Parameshwar, Nikhil D. Pai, Pradosh Dangui, Ms. Purna Bhandari, Santosh Salvador Rebello, Jai Dehadrai, Ms. Nikita Nadkarni, Ashvek Anil Gosavi, Ashish Krishnanath Kuncoliencar, Anshuman Srivastava, Anjun Bobde, Amogh Prabhu Desai, Ms. Richa Relhan, Ms. Richira Gupta, Ms. Sneha Tendulkar, Ms. Sanyya Pawar, Aurobindo Gomes Pereira, Abhishake Bhardvaj, Ms. Akshaya Ashish Joglekar, Ms. Mayuri Nayyar Chawla), Advocates, for the State of Goa.

2.

Fali S. Nariman, Madhusudan R Naik, Ashok Desai, S.S. Javali, Shyam Divan, Ms. Indira Jaisingh, Senior Advocates, Ravi Varma Kumar, S. Vijayshankar, former Advocates General for the State of Karnataka, (Mohan V. Katarki, Brijesh Kalappa, Subash C. Sharma, Maruti B. Zirali, Smt. Anitha Shenoy, Ranvir Singh, Nishanth Patil, Rajadhyax, Ms. Anuradha Bindra, Kashi Vishweshwar), Advocates, for the State of Karnataka.

3.

D.M. Nargolkar, Mr. Shamik Ghosal, and Viraj Kadam, Advocates, for the State of Maharashtra.

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – I

Sl. No.

1.

DESCRIPTION

Introduction and Constitution of Tribunal

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vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6 – 7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.3014 passed in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies and discrepancies in the Pleadings of

the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

b

11.	**Details of further Amendment of their respective Statement of cases/claims by the three States as well as the Replies and Rejoinders thereto.**	
Order dated 06.05.2015 passed in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.		
Prayers of State of Goa		
Prayers of State of Karnataka		
Prayers of State of Maharashtra		
80 - 83		
12.		
84 - 86		
13.		
14.		
15.		
86 - 92		

92 - 95

95 - 99

c

1

INTRODUCTION AND CONSTITUTION OF THE TRIBUNAL

1.

The present Tribunal, fully named as Mahadayi Water Disputes Tribunal, (hereinafter, for short called 'The Tribunal'), was constituted by the Government of India, vide a notification dated November 16, 2010, under the provisions of The Inter-State River Water Disputes Act, 1956, (hereinafter referred to as the Act). This Tribunal was constituted to adjudicate Inter-State river water disputes between the three basin States of Goa, Karnataka and Maharashtra, relating to the inter-State river Mahadayi and the river valley thereof.

2.

Before touching even the basic contours of the controversy, involved in the present dispute, it would be apt to notice the shadows of the timeline, leading to the crystallization of the 'Disputes'.

3.

Controversy over the sharing of the water of the Mahadayi or Mandovi River between the states of Maharashtra,

Karnataka and Goa is, perhaps, more than 30 years old, since attempts for negotiations appear to have been initiated by the central government as far back as 1985.

4.

The water sharing issue appears to have reached a flashpoint in 2002, when the State Government of Karnataka, decided to implement the inter-connecting canal from Kalasa Nala to Malaprabha river for diversion of waters of Mahadayi basin to Malaprabha basin.

5.

In the month of July 2002, the State of Goa made a request to the Government of India, under Section 3 of the Inter-State River Water Disputes Act, 1956, (as amended), for constitution of the Tribunal under the said Act, and refer the disputes for adjudication and decision thereof. It further appears that the issues mentioned in the request made by the State of Goa also included the assessment of available utilisable water resources in the basin at various points, and allocation of this water to the 3 basin States, keeping in view priority of the use of water within basin as also to decide the machinery to implement the decision of the Tribunal etc.

6.

Thereafter, efforts appear to have been made by the Government of India to settle the aforesaid disputes amicably. In continuation of this process, Hon’ble Union Minister for Water Resources also convened some inter-State meetings at the level

3

of

Chief

Ministers

of

the

States

of

Goa,

Karnataka

and Maharashtra. However, when it appeared that the disputing States were not ready to pursue the negotiation process further, the Central Government in the Ministry of Water Resources concluded that the disputes contained in the request of State of Goa of July, 2002 could not be resolved by negotiation and, as such, initiated further action in the matter as per the provisions of Inter-State River Water Disputes Act, 1956 and rules made there under.

Meanwhile the Govt. of Goa filed an Original Suit No. 4 of 2006 in the Hon’ble Supreme Court in Sept., 2006, for setting up

of a Water Dispute Tribunal, for adjudication of the aforesaid river water disputes. An interlocutory Application (IA), for stay of construction activities, was also filed by the said State. The said Suit, with the application for interim relief, was listed on a number of occasions before the Hon'ble Supreme Court. During the pendency of the aforesaid proceedings before the Supreme Court, the Government of India considered and approved the proposal of constitution of this Mahadayi Water Disputes Tribunal.

7.

Central Government, thereafter, constituted this Mahadayi Water Disputes Tribunal (MWDT), vide a notification dated November 16, 2010 which reads as under:-

“ MINISTRY OF WATER RESOURCES

NOTIFICATION

New Delhi, the 16 th November, 2010

S.O.2786 (E).-Whereas a request has been received under section 3 of the Inter-State River Water Disputes Act, 1956 (33 of 1956), from the State Government of Goa to refer the water disputes relating to the Inter-State river Mahadayi, and the river valley thereof, to a Tribunal for adjudication;

And whereas, the State of Goa, Karnataka and Maharashtra are the basin States of Mahadayi river and the Central Government is of the opinion that the water disputes relating to the inter-State river Mahadayi, and the river valley thereof cannot be settled by negotiations;

Now, therefore, in exercise of the powers conferred by Section 4 of the said Act, the Central Government hereby constitutes a Water Disputes Tribunal to be called as “the Mahadayi Water Disputes Tribunal”, with its headquarters at New Delhi, for the adjudication of the water disputes relating to the inter-State river Mahadayi, and the river valley thereof, consisting of

the following members nominated in this behalf by the

Chief Justice of India, namely:-

1. Hon'ble Mr. Justice J. M. Panchal,

Judge, The Supreme Court of India

2. Hon'ble Mr. Justice Viney Mittal,

Judge, High Court of Madhya

Pradesh

3. Mr. Justice P.S.Narayana, Former

Judge, High Court of

Andhra Pradesh

- Chairman

- Member

- Member

[F.No.19/4/2010-BM]

DHRUV VIJAI SINGH

Secy. (WR)"

Further, the Central Government vide a later notification dated November 13, 2014, decided that the effective date of the constitution of this Mahadayi Water Disputes Tribunal would be

August 21, 2013, instead of November 16, 2010.

8.

Taking cognizance of the aforesaid notification dated November 16, 2010, and the consequential reference dated January 11, 2011, the Supreme Court of India passed an order dated January 20, 2011, in the Original Suit, filed by the State of

Goa, whereby the said Suit was disposed of. The Order dated January 20, 2011, specifically records the following:

"Be that as it may be, since there has been request of the aforesaid three State Governments for referring the Water dispute to the Tribunal, we take the aforesaid Notification on record whereby all the disputes regarding the inter-State River Mahadayi and the River Valley thereof are referred to the aforesaid Tribunal for adjudication and decision. In view of this order, all the issues that have been raised in this Suit could be effectively raised before the aforesaid Tribunal in accordance with law".

ORDER DATED 16.10.2012 PASSED BY THE TRIBUNAL IN I.A. NO. 2 OF 2012 FILED BY THE STATE OF GOA WHEREBY DIRECTIONS WERE GIVEN TO THE THREE STATES TO FILE THEIR RESPECTIVE STATEMENT OF CLAIMS

9.

The order dated 16/10/2012 passed by the Tribunal in I. A. No. 2 of 2012, indicates that in view of the agreement

between the learned Counsels for the parties, the three States were directed to file their respective Statements of Claims on or before December 20, 2012 with the Registrar of the Tribunal. Each Statement, to be filed, was to set-forth as fully as may be necessary for the information of the Tribunal- (a) its case; (b) the facts, the data, documents and other materials, upon which its

case is based; (c) the propositions of law on which it relies; and (d) reliefs sought. It was further clarified in the Order that the parties would be at liberty to set-forth all the facts, materials, data and documents as Annexures to the Statement of Claim. The parties were further directed to file a Statement of Replies on or before February 15, 2013. Rejoinder, if any, was directed to be filed on or before March 1, 2013, dealing with each allegation of facts and the law made in the Statement of Claim as fully as may be necessary, to apprise the Tribunal of the precise dispute between the parties.

CHRONOLOGICAL DETAILS OF THE STATEMENT OF CASES/CLAIMS FILED BY THE STATES OF GOA, MAHARASHTRA AND KARNATAKA ALONG WITH REPLIES AND REJOINDERS.

10.

Pursuant to the above mentioned directions, the State of Goa filed its Statement of Claim, on 04.02.2013 (Volume 28). In reply to the Statement of Case filed by the State of Goa, the State of Karnataka filed its para-wise reply on March 18, 2013 (Volume 33) and prayed that the claim of State of Goa be

rejected.

In reply to the Statement of Case filed by the State of Goa, the State of Maharashtra filed its para-wise reply on March 15, 2013 (Volume 39). The State of Maharashtra denied the claim advanced by the State of Goa and submitted that the State of Goa is not entitled to any relief as prayed for in its Statement of Case. The State of Goa filed its para-wise Rejoinder Affidavit to the reply filed by the State of Karnataka, to the Statement of Case by State of Goa on July 15, 2013 (Volume 44) and denied the contents submitted in the reply of State of Karnataka. The State of Goa also filed its para-wise Rejoinder Affidavit to the reply filed by the State of Maharashtra to the Statement of Case of State of Goa on July 15, 2013 (Volume 45).

11.

The initial Statement of Case was filed by the State of Maharashtra on January 2, 2013 (Volume 27). The reply to the same was filed by the State of Goa on May 14, 213 (Volume 37), whereas the State of Karnataka had filed its reply dated March 18, 2013 (Volume 35).

On receipt of the above mentioned replies, the State of

Maharashtra had filed rejoinder dated July 3, 2013 (Volume 41) to the reply filed by the State of Maharashtra. Similarly, another

Rejoinder was filed by the State of Maharashtra on July 3, 2013 (Volume 42) to the reply filed by the State of Karnataka to the Statement of case filed by the State of Maharashtra.

12.

State of Karnataka initially had filed Statement of Claims on January 2, 2013 (Volume 10) to which reply was filed by the State of Goa on May 14, 2013 (Volume 38), whereas the State of Maharashtra had filed its reply dated May 15, 2013 (Volume 40).

Thereafter on receipt of replies mentioned above, the State of Karnataka had filed Rejoinder dated July 15, 2013 (Volume 47) to the reply dated May 15, 2013 filed by the State of Maharashtra.

Similarly, the State of Karnataka had filed Rejoinder dated July 15, 2013 (Volume 46) to the reply dated May 10, 2013 filed by the State of Goa on May 14, 2013.

ISSUES ORIGINALLY FRAMED BY THE TRIBUNAL VIDE ORDER DATED 21.08.2013

13.

Thereafter, the learned Counsel for the parties had stated at the Bar that the pleadings in all respects were complete. The Registry had also informed the Tribunal that the

pleadings were complete. As the pleadings were complete, the learned Counsel for the parties urged the Tribunal to frame issues for determination. Having regard to the pleadings of the parties, the following issues were framed for determination vide Order dated August 21, 2013:

1. Whether the basic data and information essentially required for arriving at most reasonable assessment of water availability of the inter-State river Mahadayi are available?

2. Whether the State of Goa proves that as the river Mahadayi flows through three sanctuaries, the State of Karnataka and State of Maharashtra require prior clearance of NBWL in addition to all the statutory and other clearances?

3. Whether it is proved by the State of Goa that Zuari basin is inter-connected with Mahadayi basin through Cumbharjua Canal, which runs in a north-south direction and any diversion of waters from river Mahadayi would affect the navigational channel?

4. Whether the State of Goa proves that the data available at various observation stations, particularly the hydro-meteorological and hydrological observation stations are not reliable and adequate? If not, what are the bare minimum data and information essentially required to be collected for arriving at most reasonable

assessment of water availability of the inter-State river Mahadayi?

5. Whether the State of Goa establishes that after assessing and deducting the available waters of river Mahadayi, for ecological sustenance of the river valley eternally, specifically giving due consideration to the scientifically predicted global warning, sea level increase, increased activity ingress in coastal areas, etc., the shares of all the riparian States should be determined on the basis of remainder water available from river Mahadayi?

6. Whether the State of Goa proves that there was no actual gauging of (a) the river Mahadayi covering the entire basin and at each of the tributaries and (b) rain to assess the complete yield of the river and, therefore, gauge data collected by CWC at Ganjim and Collem sites is unreliable?

7. Whether the State of Goa proves that the water availability assessment of the inter-State river Mahadayi

should be 75% of the dependable flow at various points in the basin and at Karnataka's disputed project site?

8. Whether the water availability assessment of the inter-State river Mahadayi should be made at the rate of percentage of more than one suggested by the States?

9. Whether the State of Goa proves that appropriate methods for the purpose of determination of the yield of the river are not employed and traditional

methods of the determination of the yield would not apply in case of Mahadayi?

10. Whether the State of Goa establishes that the equitable share of three co-basin States in the quantity of water available from river Mahadayi should be adjudicated after taking into consideration the long term in-basin needs of the three States for the purpose of domestic water supplies, irrigation, hydro-power generation, navigation, pisciculture and environmental project?

11. Whether the State of Goa establishes that on the basis of the master plan prepared by the Panel of Experts for Mahadayi basin area in the State of Goa, the projected water requirement of the State of Goa, by 2051 AD would be 2674 Mcum?

12. Whether the State of Goa proves that in basin needs be given priority over any contemplated extra basin diversions and whether there is any surplus left for extra basin diversions after adequately providing for

long term in basin needs?

13. Whether the State of Goa proves that the State of Karnataka and the State of Maharashtra do not have any right, authority or power to divert the waters of river Mahadayi outside the river basin without the concurrence of State of Goa?

14. Whether it is proved by the State of Goa that no co- basin State can take up any project on an inter-State river without the consent of the riparian States?

15. Whether the State of Goa establishes that specific restraints or restriction be placed on the upstream riparian States with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable share of Mandovi river basin waters?

16. Whether the State of Karnataka proves that the water availability assessment of the inter-State river Mahadayi should be 50% of the dependable flow?

17. Whether the State of Karnataka establishes that the total available water for allocation amongst the basin States in the inter-State river Mahadayi and its valley is not less than 220 tmc at 50% dependability or 199.6 tmc at 75% dependability as estimated by the Central Water Commission in its reports of October 2001 and March 2003?

18. Whether the State of Karnataka establishes that the effect of unequivocal withdrawal of the contentions in para 28(iv) and 28(v) of its complaint dated 9.7.2012

vide letter dated 10.1.2007 addressed by the State of Goa to the Secretary, Union Ministry of Water Resources, New Delhi bars the State of Goa from objecting to drinking water needs to the twin cities of Hubli-Dharwad, including villages enroute, etc. (including Kundagol town) from Malaprabha Reservoir?

19. Whether the State of Karnataka establishes that the State of Karnataka is not in a position to meet its Hubli-Dharwad water supply requirements from locally

available water resources as initially contended by the State of Goa and that there are no alternative sources available to the State of Karnataka from which the water supply needs of Hubli-Dharwad could be met?

20. Whether the State of Karnataka proves that it is entitled to utilization of 1.50 tmc of waters of the inter-State river Mahadayi within the Mahadayi basin located in Karnataka for irrigation, drinking purposes and other purposes?

21. Whether the State of Karnataka proves that the assessment of water availability should be made on the basis of water available at Haltar Dam, Kalasa Dam, Kotni Hydro Power Dam, Bail Nadi Dam site, Bhandura Dam site and entire catchment in Karnataka and Ganjim G&D site on main river, Khandepar at Collem G&D site and entire catchment upto mouth of the sea of Goa in the inter-State river Mahadayi and its valley?

22. Whether the State of Karnataka proves that its share in the waters of inter-State river Mahadayi and its

valley is not less than 24.15 tmc for consumptive utilization?

23. Whether the State of Karnataka proves that it is entitled to divert out of its own equitable share for consumptive utilization: (a) 7.56 tmc to provide drinking water to Hubli-Dharwad cities under the Kalasa-Bhanduranala projects; (b) 5.527 tmc to Kali basin to augment the flows of Kali for hydro-power generation under Kali Hydro-Electric Project (KHEP); and (c)

remaining water for generation of power under Mahadayi Hydro-Electric Project (MHEP) at Kotni?

24. Whether the State of Karnataka proves that the inhabitants of twin city of Hubli-Dharwad, towns and villages have a right to drinking water from the waters of inter-State river Mahadayi diverted under the Kalasa-Bhanduri project? If so, does not such right have a higher priority over other uses of the waters of the said river?

25. Whether it is proved by the State of Karnataka that drinking water has the highest priority among the uses of water as universally accepted and recognized by the National Water Policy and that the right to drinking water is also a fundamental right guaranteed under Article 21 of the Constitution?

26. Whether the State of Karnataka proves that it is entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of water every year of the inter-State river Mahadayi to the

Malaprabha river in the Krishna basin and whether the State of Karnataka is justified in diverting waters of the inter-State river Mahadayi and its valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project? If so, what extent of diversion is just and reasonable?

27. Whether the State of Karnataka establishes that it has a right to construct a project unilaterally without consent or concurrence of the co-riparian State as held

in the case of *Stateof Karnataka* v. *Stateof Andhra Pradesh* in(2000) 9 SCC 572 at 640?

28. Whether the State of Karnataka proves that the State of Goa has failed to establish that it is or is likely to be affected prejudicially by the diversion of waters of inter-State river Mahadayi and its valley as proposed by Karnataka?

29. Whether the determination of share of Maharashtra State or any other co-basin State as a result of augmentation of waters in Krishna basin (due to transfer of water from river Mahadayi) should be undertaken while examining the claims of co-basin States?

30. Whether the State of Maharashtra or any other States would be entitled to have share from the additional power that would be generated by the State of Karnataka as a result of augmentation of waters in the Kali basin due to diversion of water to Kali Hydro Power Project?

31. Whether the State of Maharashtra proves that water availability assessment should be made on the basis of total availability of water in the Mahadayi river basin?

32. Whether the State of Maharashtra proves that considerable gauge data has been collected by CWC at Ganjim and Collem sites and that gauge data at Anjumen dam existing in State of Goa should be

collaborated with CWC data to determine average annual yield from the entire Mandovi river basin?

33. Whether the State of Maharashtra proves that it is entitled to allocation of 180.00 Mcum water from total yield of river Mahadayi?

34. Whether the State of Maharashtra proves that the State of Karnataka should not be allowed to divert waters outside the basin without the consent of the State of Maharashtra and the State of Goa?

35. Whether the State of Maharashtra proves that the State of Karnataka is not entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of water as claimed by it every year of the inter-State river Mahadayi to the Malaprabha river in the Krishna basin to the prejudice of the existing and contemplated projects of Maharashtra, including the Virdi (Morachi Rai) project?

36. Whether the State of Maharashtra proves that the State of Karnataka is not justified in diverting waters

of the inter-State river Mahadayi and its valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project?

37. Whether the State of Maharashtra proves that its share in the power should be determined on the basis of the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of waters to Kali Hydro Power Project?

38. Whether project wise restrictions should be placed on the storages and utilization of waters of river Mahadayi?

39. Whether storages of projects of upper riparian States should be determined to meet their allocation?

40. Whether the upper riparian States can construct over the year storages/carry over storages?

41. Whether there should be clear directions for timely and periodic releases from projects in upper reaches to enable the lower riparian State to realize its allocations or designed success rate of its projects, without affecting success rate of the projects/allocation of the upper riparian States?

42. Whether any scheme may be framed for conservation of water over and above the allocated shares of the States by constructing reservoirs wherever possible which may be regulated by a regulatory authority for the benefit of the three riparian States wherever there may be any shortfall?

43. Whether any machinery should be set up to make available and regulate allocation of water to the States concerned or otherwise to implement the decision?

44.

What award?

VISIT OF THE TRIBUNAL TO DIFFERENT SITES AND THE REPORT DATED 12.02.2014 OF THE ASSESSORS ON THE VISITS OF THE TRIBUNAL.

14.

After the framing of the above mentioned issues for determination, the State of Goa had moved I.A. No. 17 of 2013 and prayed the Tribunal to inspect the site of inter-connecting canal of Kalasa-Bhandura project located at Kankumbi, Karnataka, on such dates as be convenient to the Tribunal. The said prayer was accepted and the Tribunal had visited different sites in the three States from December 12, 2013 to December 24, 2013. At the time of inspection of the sites, the two learned Assessors, the then Registrar of MWDT, the then Assistant Registrar of MWDT, PPS to the Chairman, Assistant, MWDT as well as the learned Counsel for all the three States had accompanied the Members of the Tribunal.

15.

After the visit of the sites, located in three different States, the learned Assessors had submitted a report dated

12.02.2014 to the Tribunal. The said Report was titled as

“REPORT ON THE VISIT OF THE HON’BLE MAHADAYI WATER

DISPUTES TRIBUNAL ALONG WITH LEGAL AND TECHNICAL TEAMS

OF THE CO-BASIN STATES TO VARIOUS RELATED PROJECTS/SITES

20

ETC.

IN

STATES

OF

GOA,

KARNATAKA

AND

MAHARASHTRA DURING DECEMBER 12- 24, 2013".

The Report

was in two parts. However, in Part II of the Report, technical data, maps etc. are incorporated and, therefore, it is not necessary for the Tribunal at this stage to refer to the said Volume No. II in detail. However, Volume I of the Report is reproduced here for ready reference:

" REPORT ON THE VISIT OF THE HON'BLE MAHADAYI WATER DISPUTES TRIBUNAL ALONG WITH LEGAL AND TECHNICAL TEAMS OF THREE CO-BASIN STATES TO VARIOUS RELATED PROJECTS/SITES ETC.

1.0 BACKGROUND

At the request of the Government of Goa and with the concurrence of the co-basin States of Karnataka and Maharashtra, the Hon’ble Mahadayi Water Disputes Tribunal (MWDT) along with the members of the legal and technical teams of the co-basin States of Goa, Karnataka and Maharashtra undertook a visit to various important projects, sites etc. with the objective of getting acquainted with the salient features of the basin and important activities related to development and management of water resources in the basin.

21

2.0

THE PROGRAMME FOR VISIT OF PROJECTS/SITES

visited identified projects/sites and

in specific activities as mentioned

The team

participated

hereunder:

13.12.2013

14.12.2013

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16.12.2013

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17.12.2013

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18.12.2013

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a. Visit to Mormugao Port Trust

b. Visit to Cumberjua Canal

a. Visit to “Virdi Large Minor Irrigation Project” under construction by Govt. of Maharashtra

b. Visit to existing “Morlem Lift Irrigation Scheme” in Goa

a. Visit to Hydrological Observation Station of CWC at Ganjim

b. Visit to existing “Opa Water Works” in Goa

c. Presentation by Water Resources Department and Forest Department of Govt. of Goa

a. Visit to “Mhadei Wildlife Sanctuary”

b. Visit to existing “Anjunem Dam” in Goa

a. Visit to proposed “Haltara Dam” site across Haltara Nala in Karnataka

b. Visit to the confluence of Surla Nala and Kalasa Nala

22

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19.12.2013

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20.12.2013

21.12.2013

23.12.2013

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c. Visit to proposed “Kalasa Dam” site across Kalasa Nala in Karnataka

d. Visit to “Inter -connecting Canal connecting proposed Kalasa reservoir to Malaprabha river” under construction in Karnataka

a. Visit to proposed “Bhandura Dam” site across Bahndura Nala

in Karnataka

a. Visit to existing “Kali Power

Project” in Karnataka

a. Visit to existing “Malaprabha

Project” in Karnataka

a. Presentation by Govt. of

Karnataka

3.0 VISIT TO VARIOUS PROJECTS / SITES AND POINTS EMERGED DURING INTERACTION WITH OFFICIALS.

3.1

Visit to Mormugao Port Trust.

A presentation was made by the Chairman, Mormugao Port Trust. He highlighted salient features of the Mormugao Port including its important role in gross domestic product (GDP) of the State of Goa. During the presentation, he also made a mention about the likely impact of reduction in the flow in the river Mahadayi on the operation of the Mormugao Port and hence on State’s economy. A copy of the presentation made before the Hon’ble Tribunal is at Annexure -I. Thereafter, the Hon’ble Tribunal and other members of the Team

taken around various facilities, particularly the iron ore loading facilities.

During the presentation, the Advocate General, Govt. of Karnataka observed that the statements of the Chairman, Mormugao Port Trust in respect of the activities undertaken or planned by the Govt. of Karnataka were beyond his briefs and that such statements should not be made. It was clarified that the objective of the visit by the Hon'ble Tribunal was to get acquainted with the salient features of the basin and important related activities etc. and that the statements made during the visit would not be taken note of and would not constitute part of the proceedings of the Hon'ble Tribunal unless the same constituted part of t he Statement of Case or Statement of Claims made by the respective States.

Based on the contents of the presentation, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and

clarifications made, following important points emerged:-

a. Many of the information made available during the course of presentation did not constitute part of the Statement of Case or Statement of Claims made by the States before the Hon’ble Tribunal.

b. No specific studies have been made by Mormugao Port Trust in respect of the minimum quantity of water in river Zuari and river Mandovi that would be

required to address the specific issues highlighted in the presentation made.

c. Mormugao Port Trust has not undertaken any study related to future fresh water requirements from rivers and also through other conservation measures including rainwater harvesting etc.

d. Mormugao Port Trust has not made any comprehensive evaluation of likely impacts of water resources development in the entire basin covering all planned developmental activities by all the three co-basin States.

e. Mormugao Port Trust has neither prepared any proposal to address the specific issues highlighted during the presentation nor taken up the same with the Govt. of India.

3.2

Visit to Cumberjua Canal:

Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team started

from Panaji Jetty and after moving in the upstream of river Mandovi entered into Cumberjua canal and travelled to a considerable distance. A brief note provided by Govt. of Goa on Cumberjua canal highlighting important features is at Annexure – II. During the travel along the canal, the Team could observe low lying ancient reclaimed land called as Khazan land along the banks of the Cumberjua canal. Members of the visiting Team could also observe crocodile on the bank of the canal.

Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:-

a. Cumberjua canal is a natural canal connecting the rivers Mandovi and Zuari in the tidal zone.

b. Cumberjua canal is used as navigation channel for barges to carry ores during high tides and traffic of empty barges during low tides.

c. The flow regime of rivers Mandovi and Zuari are impacted by the canal whenever there is increase or decrease in flow in any of the rivers.

3.3 Visit to "Virdi Large Minor Irrigation Project" under construction by Govt. of Maharashtra:

Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and the members of the visiting Team were briefed about important features of the "Virdi Large Minor Irrigation Project" which is being implemented by

Konkan Irrigation Development Corporation of the Govt. of Maharashtra. The members of the visiting team were also taken at the site of construction of the dam where work was in progress. A copy of the brief note on the project as made available by Govt. of Maharashtra is at Annexure – III.

Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:-

a. Although the "Virdi Large Minor Irrigation Project" has reportedly been administratively approved by Govt. of Maharashtra and the project is planned to be completed by the year 2015 for utilization of about 0.52 tmc of water, the mandatory clearances by the Union Ministry of Environment and Forests are still awaited.

b. Works related to rehabilitation of persons likely to be displaced by the project has not yet been completed.

c. Govt. of Goa has raised objection to the construction of the project, particularly in view of proposal of Govt. of Maharashtra for diversion of water outside Mahadayi basin through proposed changes in the project features including the height of the dam.

Representative of Goa also expressed apprehension that the project would impact the availability of water and result in water crisis at Padoshem Water Treatment Plant and Sankhalim Water Treatment Plant.

3.4 Visit to existing “Morlem Lift Irrigation Scheme” of Govt. of Goa.

Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were

briefed about important features of the existing "Morlem Lift Irrigation Scheme" of the Govt. of Goa. As per the information provided by the Officials of Govt. of Goa, the scheme was primarily undertaken as part of the rehabilitation of 282 displaced families due to construction of Anjunem dam and the scheme provides drinking water supply as also water for irrigating 282 Ha. of land. Important features of the scheme as provided by the Govt. of Goa are indicated in Annexure – IV. There were no specific questions from the member of the Visiting Team.

3.5 Visit to Hydrological Observation Station of Central Water Commission at Ganjim:

Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and the members of the visiting Team were briefed about the important aspects of gauge and discharge observation at the hydrological observation site of Central Water Commission at Ganjim by the Superintending Engineer of Central Water Commission.

The representative from Goa mentioned about the unreliability of data citing variations in observed discharge for the same observed water levels. The representative from Karnataka indicated that the observations made at the site were reliable.

Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and

clarifications

emerged:-

made,

following

important

points

a. Hydrological observation site was established on river Madei in May 1971 near Usgaonand the same was relocated near Ganjim village on the upstream with effect from January 1979 in view of backwater effect of sea waves.

b. Relatively longer series of more than 42 years of observed water level and discharge data are available for river Mahadayi at the hydrological observation station of Central Water Commission at Ganjim.

c. As per the information provided by the Superintending Engineer, Central Water Commission, the procedure prescribed in the Bureau of Indian Standard Code 1192 for discharge

observation are strictly adhered to at the site.

d. Neither Central Water Commission nor Water Resources Departments of Govt. of Goa, Govt. of Karnataka and Govt. of Maharashtra have undertaken detailed studies for consistency checks of the observed data at the site.

e. Two control structures namely barrages, one in the upstream and the other in the downstream of the hydrological observation site at Ganjim have also come up during last 5 to 10 years which call for proper consistency checks and accounting for the diversions from such structure for realistic

assessment of overall availability of water up to the hydrological observation station at Ganjim.

f. There are two nearby discharge observation sites of Govt. of Goa, one at Khadikei on river Madei in the upstream of Ganjim and other at Paikul on Ragda, a tributary of river Madei.

g. In addition to above, Govt. of Goa has also established a few more hydrological observation stations under the ongoing Work Bank assisted Hydrology Project.

h. Hydrological data observed by various Central and State Government agencies and related information have not been shared with each other although sharing of hydrological data and other related data and information are essentially required for carrying out meaningful consistency checks and evaluation of desired characteristics of the available resources.

3.6 Visit to existing “Opa Water Works” of Govt. of Goa:

Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about important features of the existing “Opa Water Works”. Important features of the “Opa Water Works” as provided by the Govt. of Goa are at Annexure – V.

Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:

a. Total water pumped from river Khandepar, a tributary of river Mahadayi at "Opa Water Works" site is only of the order of 114 million litres per day which is equivalent to only about 0.147 tmc per annum.

b. There is tidal effect in the downstream reach of Opa and hence there is a limitation in use of water from the lower reaches of the river for drinking purposes.

c. Although there is need for undertaking measures for rainwater harvesting including construction of check dams etc., such measures have not been taken up on large scale due to various factors. Representatives for Govt. of Goa informed that the construction of check dams on large would not be feasible since the land is

relatively flatter in the lower reaches.

3.7 Presentation by Water Resources Department and Forest Department of Govt. of Goa:

Following presentation were made before the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and the members of the visiting Team:

a. "Flowing with Mahadayi" by Water Resources Department, Govt. of Goa.

b. “Diversion of Kalsa river (Surla) and i mpact on biodiversity of Surla valley in Madei Wildlife Sanctuary” by Goa Forest Department, Govt. of Goa. Copies of the presentations are at Annexures – VI and VII respectively. A brief Note titled “Surla River Diversion Project and its after effect in relation to Madei Wildlife Sanctuary” provided by the Goa Forest Department is at Annexure – VIII.

3.8

Visit to “Mhadei Wildlife Sanctuary”:

A brief note provided by Govt. of Goa on Mahadayi Wildlife Sanctuary highlighting important features of the Mahadayi Wildlife Sanctuary is at Annexure – IX. Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team could see important features such as waterfalls, diverse nature of flora etc. from two different locations. The natural beauty of the surroundings were highly appreciated by all the visitors. There were no

specific questions during the visit.

3.9

Visit to existing “Anjunem Dam” of Govt. of Goa:

Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about important features of the existing “Anjunem Dam”. Important features of the dam as provided by the Govt. of Goa are at Annexure – X.

Based on the information provided by the officials, replies to the queries of t he Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:-

a. Anjunem is the largest water resources development project in Goa with gross storage capacity of 44.83 million cubic meters (about 1.58 tmc). The right bank main canal and left bank main canal have capacity of 1.60 cubic meters per second and 1.03 cubic meters per second respectively and total command is 2100 hectares.

b. In view of relatively lesser water flow during the period from December to May, Govt. of Goa has proposed a new dam at Ponsule in the upstream reach of the river and the reservoir created behind the proposed dam is planned to serve as balancing reservoir as well and increase the water utilization from Anjunem.

3.10 Visit to (a) “Haltara Dam” site proposed by the Govt. of Karnataka across Haltara Nala, (b) Confluence of Surla Nala and Kalasa Nala and (c) “Kalasa Dam” site proposed by the Govt. of Karnataka across Kalasa Nala: During their visit to the (a) proposed “Haltara Dam” site across Haltara Nala, (b) confluence of Surla Nala and Kalasa Nala and (c) proposed “Kalasa Dam” site across Kalas a Nala, Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about important features of the

proposals in respect of two dams and the overall proposal related to diversion of water from Mahadayi basin to Malaprabha reservoir. Brief notes provided by Govt. of Karnataka in this regard are at Annexure – XI. Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:

a. Mandatory clearances of Ministry of Environment and Forests have not been accorded in respect of the two proposed dams namely Haltara dam and Kalasa dam.

b. Observed stream flow data are not available at the two proposed dam sites (namely Haltara dam site and Kalasa dam site) and the yield at the two sites have been assessed by using Inglis formula (an empirical formula).

c. With construction of proposed 5.5 kilometre long

interconnecting canal (connecting Haltara reservoir with Kalasa reservoir), the canal would transfer 0.56 tmc of water from Haltara reservoir and 0.85 tmc from part of Surla catchment (i.e., total of 1.41 tmc) to Kalasa reservoir. This quantity of water along with 2.15 tmc of water from Kalasa reservoir i.e., total of 3.56 tmc of water is proposed to be transferred to Malaprabha reservoir through another interconnecting canal connecting Kalasa reservoir to Malaprabha river.

d. Proposed diversion of 0.56 tmc of water of Haltara Nala catchment, 0.85 tmc from part of Surla Nala catchment, and 2.15 tmc from Kalasa Nala catchment would definitely result in reduction in flow in the downstream reaches of the respective Nalas and subsequently in the rivers where these Nalas join.

e. Likely impact of reduction in flows (in the eventuality of construction of Haltara dam, Kalasa dam, Interconnecting canal (connecting Haltara reservoir with Kalasa reservoir), and Interconnecting canal connecting Kalasa reservoir to Malaprabha river have not been critically examined particularly from the viewpoint of impact on wildlife sanctuary located in the downstream reaches of these Nalas both in Karnataka and Goa.

3.11 Visit to “Inter -connecting Canal connecting proposed Kalasa reservoir to river Malaprab ha” under construction by the Govt. of Karnataka:

During their visit to the “Inter -connecting Canal

connecting proposed Kalasa reservoir to river Malaprabha" which is under construction by the Government of Karnataka, Hon'ble Chairman, MWDT, Hon'ble Me mbers of MWDT and the members of the visiting Team were briefed about important features of the works under construction and were taken around some of the locations where constructions were in progress. Replying to a specific query of the representative of Govt. of Goa, the Advocate General of Govt. of Karnataka informed that the Govt. of Karnataka

is fully competent of taking up the construction works of the “Inter -connecting Canal connecting proposed Kalasa reservoir to river Malaprabha”A brief note high lighting important features and the status of progress of works as provided by Govt. of Karnataka is at Annexure – XII. Based on the information provided by the officials, replies to the queries of the Hon’ble Chairman, MWDT, Hon’ble Members of MWDT an d other participants and clarifications made, following important points emerged:

a. The use of canal for diversion of 3.56 tmc (0.56 tmc of water of Haltara Nala catchment, 0.85 tmc from part of Surla Nala catchment, and 2.15 tmc from Kalasa Nala catchment) of water would be possible only after the construction of the proposed Haltara dam, the proposed Kalasa dam and the proposed interconnecting canal (connecting Haltara reservoir with Kalasa reservoir). Necessary mandatory clearances in respect of all these components of

Kalasa-Bhanduri Project are still awaited. It was informed by the representative of Govt. of Karnataka during the visit that the proposal for seeking clearances would be considered by the competent authorities only after the award by the Ho n'ble Tribunal. Thus the "Inter -connecting Canal connecting proposed Kalasa reservoir to river Malaprabha" would remain unused even after completion of all works unless the other components namely proposed Haltara dam, the proposed Kalasa dam and the proposed interconnecting canal (connecting Haltara reservoir with Kalasa reservoir)

are accorded mandatory clearances by the competent authorities and the works are completed.

b. The representative of Karnataka also reported that in case of “flood”, some water w ould automatically get diverted to the Canal from Kalasa Nala beyond a specified water level in Kalasa Nala. Specific level beyond which water would automatically get diverted and the quantum of water through such diversion could not be ascertained in the absence of requisite detailed drawings and related information at the site. The scenario of automatic diversion of water beyond a specified level would lead to a situation of defiance of interim orders of the Hon’ble Tribunal that the State of Karnataka would not actually utilize the waters or divert the waters under Kalasa Bhanduri Project until further orders.

c. The representatives from Govt. of Karnataka could also not satisfactorily clarify as why the works have been undertaken for this component i.e., “Inter -

connecting Canal connecting proposed Kalasa reservoir to river Malaprabha" alone without prior clearances of other components, particularly in view of the fact that the canal by itself would remain unused even after its completion since its utilization is fully dependent on other components which are not yet cleared.

d. The representatives from Govt. of Karnataka could also not clarify as why the works have been undertaken on a relatively faster pace when the canal is likely to remain unused in near future.

e. It was informed that the concurrence of Central Water Commission for the design of “Inter - connecting Canal connecting proposed Kalasa reservoir to river Malaprabha” has not been obtained although in the letter dated 30.4.2002 of the Ministry of Water Resources conveying the in-principle clearance for diversion of 7.56 tmc of water from Madei basin to Malaprabha for meeting drinking water requirements of Hubli / Dharwad (which was later placed in abeyance vide letter dated 19.9.2002 of the Ministry of Water Resources), it is, inter-alia, mentioned that “Government of Karnataka will furnish all required design details to enable the CWC to satisfy itself that Karnataka does not develop technical capability for diversion of more water (than as mentioned in para ‘a’ above) at a later stage”.

f. It was observed that there are variations in the specifications (as reported in Annexure 63 of the Statement of Claims of Karnataka and that in the

information provided during the visit) and the deviations are reportedly not approved by the competent authorities and concurred-in by Central Water Commission.

g. The reason for relatively very large variations in the dimensions of the canal particularly in respect of cut & cover sections from one reach to other were not satisfactorily explained.

h. The present scenario of relatively faster pace of construction despite the fact that Canal would not be

utilised even after its completion in near future, could lead to a situation of fait accompli.

i. Govt. of Karnataka has to fully satisfy in respect of: (i) necessity; (ii) planning; (iii) design; clearance and approval by designated agencies; (iv) financial implications; and (v) legal aspects.

3.12 Visit to “Bhandura Dam” site proposed by the Govt. of Karnataka across Bahndura Nala:

During their visit to the proposed “Bhandura dam” site, Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about the proposal and the alignment of the proposed dam was shown. A brief note highlighting salient features as provided by Govt. of Karnataka is at Annexure – XIII.

Based on the information provided by the officials, replies to the queries of the Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and other participants and clarifications made, following

important points emerged.

a. The proposed location of the Bhandura dam is located in deep forest and is close to wildlife sanctuary.

b. At present, there are no good roads etc., particularly for the movement of heavy machinery required for construction of proposed dam. The construction of

dam and related activities would impact the wildlife sanctuary.

c. Mandatory clearances of the Union Ministry of Environment and Forests have not been accorded so far.

d. The project has been primarily envisaged to divert 4 tmc of water to existing Malaprabha reservoir to be used for drinking purposes. However, it is mentioned at Page 4 of the detailed project report (DPR) at Annexure – 65 of the Statement of Claims of Karnataka that the average annual yield from the catchment up to the dam site is estimated to be only 3.03 tmc (85.9 Mm3) and the 75% dependable yield has been estimated to be 2.4 tmc (66.7 Mm3). Obviously, the envisaged diversion of 4.0 tmc of water to Malaprabha reservoir from Bhandura Nala does not appear to be feasible. The project authorities or representatives of the Govt. of Karnataka present during the visit could not clarify on

this important issue of inconsistency in the data.

3.13 Visit to existing “Kali Power Project” of Karnataka Power Corporation Limited:

During their visit to the existing Supa dam of the “Kalinadi Hydro - electric Project”. Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about the salient features of the project. Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were also informed about the proposal for

diversion of 5.27 tmc of water of various tributaries of Mahadayi to augment the flows of Kalinadi for increased hydro-power generation under Kalinadi Hydro-electric Project. A brief note highlighting salient features of the project as provided by Govt. of Karnataka is at Annexure – XIV.

Based on the information provided by the officials, replies to the queries of the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and other participants and clarifications made, following important points emerged:-

a. The drawings shown at the site did not present the overall plan regarding proposed diversion from different locations of various tributaries of river Mahadayi. This could have been done through a self-contained comprehensive drawing showing all the proposals in an integrated matter.

b. The project authorities informed about reduction in water availability in the reservoir resulting in less

than envisaged generation of hydropower. However, the data presented at the site indicated that the highest value of the yield was in the year 1994 and the next highest value was in the year 2006 followed by that in the year 2011 and 2005, suggesting the absence of any trend for reduction in water availability.

c. The project authorities could not explain the reason for relatively higher estimate of the yield for the project at the time of planning of the project which

has virtually resulted in underutilization of the created facilities.

d. None of the proposed projects on the tributaries of river Mahadayi for the purpose of diversion of 5.27 tmc of water to augment the flows of Kalinadi for increased hydro-power generation under Kalinadi Hydro-electric Project have been accorded mandatory clearances from the Union Ministry of Environment and Forests.

e. The project authorities or the representatives of the Govt. of Karnataka did not clarify as how higher priority could be accorded for utilization of water for the purpose of hydro-power generation.

3.14 Visit to existing “Malaprabha Project” of Govt. of Karnataka:

During their visit to the existing “Malaprabha Project”, Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team were briefed about the salient features of the project. A brief

note highlighting salient features of the project as provided by Govt. of Karnataka is at Annexure – XV.

Based on the information provided by the officials, replies to the queries of the Hon’ble Chairman, MWDT, Hon’ble Membe rs of MWDT and other participants and clarifications made, following important points emerged:-

a. Project authorities informed that the water availability at the Malaprabha reservoir has now been assessed as 27.0 tmc against the earlier estimate of 44 tmc. This means either the initial assessment was wrong or in the later years there was reduction in the rainfall resulting in lower yield. This has not been explained.

b. It is also not explained whether the factors responsible for erroneous initial water assessment or reduction in assessed water availability at a later date would also be applicable in case of Mahadayi basin and that whether these factors have been taken in to account while assessing the water availability at various points in different tributaries in Mahadayi basin.

c. It was noted from the information provided by the project authorities during the visit that the revised detailed project report (DPR) of Malaprabha project prepared in the year 2012 envisages only 0.216 tmc

for drinking water supply purposes and not 7.56 tmc projected as the drinking water requirement for Hubli-Dharwad and en-route villages.

d. It has also not been explained as why priority for drinking water has been ignored while preparing the revised detailed project report (DPR) of Malaprabha project. This more so in view of the emphasis of the Govt. of Karnataka on drinking water being a right under Article 21.

3.15 Presentation by Govt. of Karnataka:

A presentation covering (a) various aspect of drinking water related issues of Hubli-Dharwads and reroute villages, (b) proposed Diversion Schemes from Mahdayi basin to Kali basin, and (c) proposed Mahdayi Hydro-electric Project was made by Govt. of Karnataka before the Hon'ble Chairman, MWDT, Hon'ble Members of MWDT and the members of the visiting Team.

A copy of the presentation is at Annexure-XVI.

4.0

MEETINGS WITH DELEGATIONS FROM PUBLIC:

During the visit to various Projects/Sites, a number of delegations representing various section of the Society expressed their desire to meet the Hon'ble Tribunal. Hon'ble Chairman, Mahadayi Water Disputes Tribunal and Hon'ble Member of the Mahadayi Water Disputes Tribunal met the delegations in the presence of the Legal Teams of the three co-basin States, namely Goa, Karnataka and Maharashtra at Belgaum on 19th December 2013, at Malaprabha and Hubli on 21st

December 2013. Hon’ble Chairman, Mahadayi Water Disputes Tribunal and Hon’ble Member of the Mahadayi Water Disputes Tribunal gave a patient hearing to all the delegations. It was however, made very clear to all the delegations that as per laid down procedure, the proceedings of the Hon’ble Tribunal woul d be based strictly on the pleadings made by the three States namely Goa, Karnataka and Maharashtra. The members of all the Delegations were advised that if they desired some of their views to be considered during the proceedings of the Hon’ble Tribunal, t hey get such views

included in the pleadings made by the Learned Counsels of the party States.

5.0 CONCLUDING REMARKS OF THE HON'BLE CHAIRMAN:

After completion of the last programme i.e., meeting with the officials of Government of Karnataka on 23rd December 2013, where members of the legal and technical teams of all the three States were present, Hon'ble Chairman, Mahadayi Water Disputes Tribunal concluded as under:-

"At the request of the Government of Goa and with the concurrence of the co-basin States of Karnataka and Maharashtra, we undertook this visit with the objective of getting acquainted with the salient features of the basin and important activities related to development

and management of water resources in the basin.

This visit has definitely helped us in better understanding of the important features of the basin. I am confident that the learned Members of the legal and technical teams are now better equipped to address the issues.

I would like to share with you some of the common observations which emerged during visit to various sites etc. in Goa, Karnataka and Maharashtra. Some important facts about basin features as also about water related points were highlighted by experts. But it emerged that many of the facts are

neither included in the statement of case or statement of claims of the States nor adequately elaborated.

Another very important point relates to inconsistency in information and data. This was apparent at almost all the sites which were visited in Goa, Maharashtra and Karnataka.

It also emerged that in many cases, the information were not fully substantiated through facts, authentic information etc. such as detailed plan including contour plan, detailed drawings and construction drawings wherever applicable.

I am confident that the members of the legal and technical teams will take all necessary measures to ensure that the information and data are consistent and that these are duly substantiated through authentic sources, proper studies and related documents. This will help all of us in better appreciation of the issues.

I take this opportunity to thank all the participants particularly the organisers from the three

States for making the visit very informative and

comfortable.

Sd/-

(M.E. HAQUE)

Assessor

12.02.2014

Sd/-

(S.K. SENGUPTA)

Assessor

12.02.2014 ”

46

A copy of the Report prepared by the two learned Assessors and submitted before the learned Registrar of the Tribunal was taken on the record of the case and a copy of the said Report was given to each State. This is evident from the order dated 04.03.2014 passed in I.A. No. 1/2012.

ORDER DATED 04.03.2014 PASSED BY THE TRIBUNAL IN I.A. NO. 19 OF 2014 FILED BY THE STATE OF GOA FOR AMENDMENT OF STATEMENT OF CLAIM AND THE CONSEQUENTIAL PLEADINGS OF THE PARTY STATES

16.

After filing the Statement of Case on 04.02.2013, the State of Goa had moved an application i.e. I.A.No.19/2014, seeking permission of the Tribunal to amend its Statement of Case dated 04.02.2013, in terms of the Schedule annexed to the said application along with the annexures thereto and to carry out consequential amendments to all the papers and proceedings. The said application was allowed by the Tribunal vide Order dated 04.03.2014. Further consequential directions were also issued by the said Order.

Pursuant to the liberty granted by the Tribunal vide Oder dated 04.03.2014 passed in I.A.No.19 of 2014, the State of Goa

submitted Amended Statement of Case on 07.03.2014. In reply to the amended Statement of case filed by State of Goa, the State of Maharashtra filed its para-wise reply on March 25, 2014 (Volume 68). In reply to the amended Statement of Case filed by the State of Goa, the State of Karnataka also filed its para-wise reply on March 27, 2014 (Volume 70) and denied the claim of the State of Goa in the amended Statement of Case. The State of Goa filed its Rejoinder Affidavit dated April 16, 2014 (Volume
77) to the reply filed by the State of Karnataka to the amended Statement of Case of the State of Goa. Similarly, the State of Goa filed Rejoinder Affidavit dated March 29, 2014 filed on March 31, 2014 (Volume 73B) to the reply filed by the State of Maharashtra to the amended Statement of Case filed by the State of Goa.

ORDER DATED 01.04.2014 PASSED BY THE TRIBUNAL IN I.A. NO. 21 OF 2014 FILED BY THE STATE OF MAHARASHTRA FOR AMENDMENT OF THE STATEMENT OF CLAIM AND CONSEQUENTIAL PLEADINGS OF THE PARTY STATES.

17.

The State of Maharashtra had originally filed its Statement of Claim dated 02.01.2013. Thereafter, the State of Maharashtra had moved an application i.e. I.A. No. 21/2014, seeking permission of the Tribunal to permit the State of

Maharashtra to amend its Statement of Claim. The said application was allowed by the Tribunal vide Order dated 01.04.2014 and the State of Maharashtra was permitted to amend its Sta tement of Case as mentioned in “Schedule A” to the application. Further consequential directions were also given by the Tribunal.

Pursuant to the above stated permission, granted by the Tribunal, the State of Maharashtra had filed its Amended Statement of Claim on 02.04.2014 (Volume 74). The reply by the State of Goa was filed to the same on April 16, 2014 (Volume76), whereas reply on behalf of the State of Karnataka was filed on May 7, 2014 (Volume 80), to the amended Statement of Case filed by the State of Maharashtra.

State of Maharashtra had thereafter filed Rejoinder dated September 5, 2014 (Volume 89) to the reply filed by the State of Goa to the amended Statement of Case filed by the State of Maharashtra.

Similarly, the State of Maharashtra had filed

Rejoinder on September 5, 2014 (Volume 90) to the reply filed by the State of Karnataka to the amended Statement of Case filed by the State of Maharashtra.

49

ORDER DATED 17.04.2014 PASSED BY THE TRIBUNAL IN I.A. NO.1 OF 2012 FILED BY THE STATE OF GOA FOR RESTRAINING THE STATE OF KARNATAKA NOT TO ACTUALLY UTILISE OR DIVERT THE WATER UNDER THE KALASA-BHANDURA PROJECT

18.

The State of Goa had filed I. A. No. 1 of 2012 with a prayer to restrain the State of Karnataka from proceeding with any planning, construction and water regulation of any projects in the Mahadayi River Basin involving trans-basin diversion of waters until the inter-State disputes were adjudicated by the Tribunal.

On 16 th October, 2012 following Order was passed by the Tribunal:

" O R D E R

On instructions, Mr. F.S.Nariman, learned Senior Counsel for the State of Karnataka states as follows:

"That the State of Karnataka will not actually utilize the waters or divert the waters under the Kalasa Bhanduri Project until the next date of hearing. This

statement is without prejudice to all rights and

contentions of the State of Karnataka".

The above statement made on behalf of the State

of Karnataka is accepted by the learned Counsel for the

State of Goa on instructions from Mr. S.T.Nadkarni, Chief Engineer, WRD, State of Goa. State of Goa accepts the above statement made on behalf of State of Karnataka without prejudice to the rights and contentions of State of Goa.

In view of the above statement made at the Bar, I.A. No. 1 of 2012 is adjourned to March 19, 2013."

On 17 th April, 2014 I.A.No. 1 of 2012 was taken up for further hearing and after hearing the parties, following Order was passed:

"8. In view of the consensus arrived at between the parties, the following directions are issued:

i)

The State of Karnataka is hereby directed that it shall not actually utilize the water or divert the waters under Kalasa-Bhanduri Project till the disputes arising between the three States are finally adjudicated by this Tribunal;

In order to ensure that the water from Mahadayi

basin does not get automatically diverted to Malaprabha basin through the inter-connecting canal, which has been partly constructed by the State of Karnataka, the State of Karnataka is directed to plug both the vents of the cut and cover section of the reach within Mahadayi basin of the inter-connecting canal with a brick masonry embankment, on or before 31.5.2014;

ii)

iii)

The State of Karnataka is directed to fill up the excavation made along the ridge line (the line separating the Mahadayi and Malaprabha basins) for the purpose of construction of canal, as per the agreed design and specification, to restore the ridge line as was existing prior to the construction of inter-connecting canal, on or before 31.5.2014;

The State of Karnataka is directed to complete the work of cross drainage for the existing roads/State highway along with the above mentioned works of plugging to avoid likely flooding/pondage, on or before 31.5.2014; and

In order to monitor the works to be undertaken by the State of Karnataka, a team comprising of (a) the Superintending Engineer, in-charge of the works from Government of Karnataka, (b) an officer of the rank of Superintending Engineer to be nominated by the State of Goa and (c) an officer in the rank of Superintending

Engineer to be nominated by the Government of Maharashtra is directed to be constituted immediately and latest by 30.4.2014. The so constituted team shall monitor the works to be undertaken by the State of Karnataka pursuant to the above mentioned directions. The team so constituted is directed to submit an interim report on the progress of works by 15.5.2014 and a final report on the completion of the works by the first week of June 2014 to the Registrar, Mahadayi Water Disputes Tribunal.

iv)

v)

9. Over and above the directions issued by this order, no further directions are sought for by the State of Goa.

Hence, subject to the above-mentioned directions, I.A. No. 1 of 2012 stands finally disposed of."

ORDER DATED 03.09.2014 PASSED BY THE TRIBUNAL POINTING OUT INCONSISTENCIES AND DISCREPANCIES IN THE PLEADINGS OF THE PARTY STATES

19.

On perusal of the respective pleadings of the three-party States, and the data available on the record and also on account of the facts assimilated from a site visit conducted by the Chairman and Members of the Tribunal, along with Assessors, some glaring inconsistencies and discrepancies were noticed. In these circumstances, detailed notes mentioning those inconsistencies and discrepancies were prepared and handed over to all the concerned parties by this Tribunal. A detailed Order was passed on September 3, 2014. It would be appropriate to reproduce the said Order dated 03.09.2014, which

reads as under:-

53

“ O R D E R

1. Today, during the course of hearing of the matter, the Tribunal has handed over copies of the “Brief Note on Inconsistencies in Data/Information related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case/Statement of Claims and Related Documents” to the learned counsel appearing in the matter. Even copies of the draft order, which the Tribunal proposes to pass on the basis of the Brief Note, were also handed over to the learned counsel appearing in the matter. The Brief Note reads as under:

1. Two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stakeholders and for different purposes are: (a) water availability assessed at various locations; and (b) water requirements for meeting the present and

future demands of water for various purposes. In addition, information related to prioritization of water use keeping in view the socio-/economic profile of the areas are also considered necessary. Though the legal issues are undoubtedly very important but rational assessment of water availability and water requirements for various purposes on a sound and accepted principles remain basic inputs.

2. The statements of case / statement of claims, written statements and rejoinders submitted by the three co-basin States along with the related documents

provide some information relating to these two basic inputs, the examination of the documents provided by the three States indicates that in many cases, the information provided by the respective States are not consistent and in some cases are contradictory. Some inconsistencies were also observed by the Tribunal during the visit to various projects / sites etc. in the States of Goa, Karnataka and Maharashtra in December 2013 which are indicated in the report on the visit. Obviously, inconsistent informations cannot be the basis of meaningful arguments during the process of arriving at reasonable assessment of the available water resources and judicious allocation of share of waters among the various stakeholders and for different purposes.

3. Without going into the merits of the facts as provided through data and informations included in the documents filed by respective State Governments and without comparing the data / information provided

by one State with that of other States at this stage, some specific cases of inconsistencies in data / information appearing in the documents are cited as under.

4. In Para 72, page 49-50 of the Statement of Case of Goa, it has been mentioned "that total 75% yield from the whole of Goa Region of Mandovi / Madei Basin is 86. 80 TMCft. (2460 MCM)". It has further been indicated in the same Para that "the total availability of water resources for developmental purpose could be only 54 TMCft (1531 MCM)". The total projected

demand of water by the year 2051 has been reported by Goa as 2674 MCM in Para 189 on page 145 of the Statement of Case of Goa. The projection of demand of 2674 Mm 3 against the utilizable available water of 1531 Mm 3 , in itself appears to be quite illogical.

Following pertinent inconsistencies/ contradictions are also observed from the Statement of Case and related document submitted by Goa.

a. Goa has raised serious objections on the hydrological data observed at Ganjim on river Mahadayi and Colem on river Khandepar (a tributary of river Mahadayi) which has been used by Central Water Commission (CWC) as well as National Water Development Agency (NWDA) for assessment of water availability. The issue of unreliability of data observed at Ganjim was also raised by Goa during the visit of the Tribunal to various projects / sites in the State of Goa, Karnataka and Maharashtra in December 2013.

However, the Tribunal noted that neither Central Water Commission nor Water Resources Departments of Government of Goa, Government Karnataka and Government of Maharashtra undertook detailed studies for consistency checks of the observed data at the site. Any conclusion about reliability or otherwise of observed hydrological data without proper consistency checks would not be appropriate.

b. In its Statement of Case, Goa has also adversely commented on the assessment of water availability by National Water Development Agency (NWDA). Goa has mentioned in Para 178,

page 130 that "these NWDA's water resources assessments are now revealed to be based on erroneous assumption of basic hydrological data such as rainfall, river discharge data……". Goa, on the other hand, appointed a "Panel of Experts" for preparation of Master Plan for the long term needs of water potential of Mahadayi river basin in Goa and has referred to the report of the "Panel of Experts" time and again. It is, however, noted that the studies of the "Panel of Experts" relating to water availability are primarily based on the findings of the technical study of NWDA as can be observed from Para 179, page 130 of the Statement of Case of Goa. <u>This presents a contradictory situation.</u>

c. Goa has not agreed with the results of the studies of Central Water Commission regarding the assessment of water availability and has stated in Para 30, page 33 of "Reply by the State of Goa to

Statement of Claims filed by the State of Karnataka before Mahadayi Water Dispute Tribunal" that "…… Goa will submit its case of quantification of useful and reliable yield available in Mandovi Basin before this Hon'ble Tribunal for its perusal and decision in due course." Further, in the Amended Statement of Case filed by Goa on 7.3.2014, it has been mentioned at Para 18D, page 15- 16 that "it is therefore submitted that with the advances in environmental and hydrological sciences, the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of

long term water requiremen ts". However, Goa has not indicated any timeframe for completion of detailed studies and individual DPRs. Therefore, at present, the projected demand of 2674 Mm 3 of water for various purposes by Goa cannot be treated as final projection.

d. Inconsistencies are noticed even in respect of some basic facts of administrative nature. For example, in Para 72, page 49 of the Statement of Case filed by Goa, it is mentioned that "to study the Karnataka proposals about diversion of water from Madei Basin to Malaprabha River, Panel of Experts (PoE) was appointed by Govt. of Goa on 14 th February 2000". The report of the PoE appointed on 14 th February 2000 has not been filed by Goa. However, "Master Plan for Madei / Mandovi River Basin – A Report by Panel of Experts" has been submitted and findings of the same have been referred to time and again. Examination of the

report of PoE (filed by Goa) indicates that PoE was constituted vide Irrigation Department letter No. 61-1/98-99-CE-IRRG-EO/24 dated 24.4.1998 and that the PoE submitted its report in 1999. Such inconsistencies indicate casual approach in furnishing information.

5. Karnataka in the Statement of Claims has mentioned in Para 9.3, page 76-77 about estimation of water availability by Central Water Commission in 2003 and has mentioned that "CWC estimated the yield of Mahadayi basin as 6234 Mcum (220 tmc) at 50% dependability and 5652 Mcum (199.6 tmc) at 75% dependability". In Para 16.14, page 124 of the

Statement of Claims, it is specifically mentioned that "… the yiel d study of the CWC of March 2003: is binding on Goa and in the facts and circumstances of the present case, it has to be taken as the basis for the determination of the shares of the riparian States in the waters of the Mahadayi river". It has been further mentioned by Karnataka in Para 9.6, page 79 of the Statement of Claims that on the basis of the methodology adopted by CWC in its Report of 2003 and the data for the period 1965-66 to 1999-2000, the 75% dependable flow and 50% dependable flow generated from the catchment of river Mahadayi and its tributaries in Karnataka works out to be 1250 Mm 3 (44.15 tmc) and 1489 Mm 3 (52.60 tmc) respectively. It has also been mentioned in the same Para that "the WRDO of Karnataka has also assessed the yield on the proportionate catchment area basis of the gross yield at Ganjim, for the period from 1979-80 to 2010-11. According to the study of WRDO of Karnataka, the

yield at 75% dependability and 50% dependability is 43.87 tmc and 50.13 tmc respectively". Karnataka has projected its share in the waters of inter-State river Mahadayi and its valley as 24.15 tmc. In this regard, some important related information are as under.

a. Karnataka has mentioned in the Statement of Claims that water availability of 5652 Mm 3 as assessed by Central Water Commission may be accepted by the Tribunal. However, in Para 4.5.1, page 4-19 of Annexure 8, volume I (NEERI report of 1997) of Statement of Claims of Karnataka, it is mentioned that "The annual average runoff from the Mandovi and Zuari basins as estimated by the CPCB is 16000 and 11000 Mcum respectively".

Further, it is mentioned on page 242, Annexure – 57 (of Statement of Case of Karnataka) that the average annual yield from Mahadayi basin in Karnataka is shown as 1470.37 Mm 3 . However, in Para 3.4.2, page 3-6 of Annexure 8, volume I, it is mentioned that "the total yield from the Mahadayi river basin in Karnataka is 1082 Mcum…..".

<u>Mentioning of such highly varying figures without cross checking the details included in different document is not at all acceptable.</u>

b. In Para 11.3, page 89-90 of the Statement of Claims, it is mentioned that "… on a fresh planning, Karnataka proposes to (i) utilize 7.56 tmc for diversion under Kalasa Bhanduri (ii) utilize 1.5 tmc for irrigation, drinking purposes and other purposes within the Mahdayi basin (iii) divert 5.527 tmc to Kalinadi to augment the flows for power generation under the KHEP and (iv) account remaining water under the MHEP for power

generation, at present". It has been further mentioned in Para 13.10, page 103 of the Statement of Claims of Karnataka that "the urgent need of meeting the drinking water requirement of Hubli-Dharwad twin cities, enroute villages, etc., has been the singular reason for starting the construction of Kalasa Bhanduri project for diversion of 7.56 tmc of water to Malaprabha river to augment its inflows". However, on page 19 of the Modified Detailed Project Report of Malaprabha Project (Annexure – 4 to the Reply on behalf of the State of Karnataka to the Statement of the Case filed by the State of Goa), the allocation for domestic water supply as per revised

project report from Malaprabha has been indicated as 15.59 LPCD which is equivalent to 0.201 tmc of water per year. The Modified Detailed Project Report of Malaprabha Project on page 19, also mentions about 0.015 tmc of water as revised allocation for industrial water supply. The total of 0.201 for drinking water supply and 0.015 for industrial water supply works out to be 0.216 tmc which has been indicated at page 17. The same figure has been shown as water supply in the brochure titled "A Note on Malaprabha Project" made available during the visit of the Hon'ble Tribunal to the Malaprabha Project during December 2013. Further, at page 135 of the Modified Detailed Project Report of Malaprabha Project, it is mentioned that "the requirement of Drinking water supply of 90 Mcft monthly for Twin cities of Hubli-Dharwad has been provided from the year 1982- 83". Since there is a reference of the

year 1982-83 from which the requirement of drinking water supply for twin cities of Hubli-Dharwad has been provided, it may be assumed that the quantum of 90 million cubic feet per month i.e., about 1.08 tmc per annum is already being supplied for Hubli-Dharwad from Malaprabha Project. However, there is lack of clarity as it is further indicated in the same Para at page 135 that "this requirement is however not accounted for utilization under Malaprabha Project". It is also stated in the same Para on page 135 that "thus drinki ng water requirement for Twin cities of Hubli-Dharwad which is lifted directly from reservoir as duly considered for utilization under

Malaprabha Project". The related Para from the Modified Detailed Project Report of Malaprabha Project is reproduced as under.

"The requirement of Drinking water supply for 90 MCft monthly for Twin cities of Hubli-Dharwad has been provided from the year 1982-83. Thus under Col. No. 7 of working table issues for irrigation and drinking is shown as 25340 MCft annually (24260 for irrigation + 1080 MCft (90 MCft x12 months)). As regards to issues for water other requirements on the downstream of dam under Col. No. 8 is actual yearly issues during the year 1973-74 to 2005-06. This requirement is however not accounted for utilization under Malaprabha Project. Thus drinking water requirement for Twin cities of Hubli-Dharwad which is lifted directly from reservoir as duly considered for utilization under Malaprabha Project."

Further, it is observed from the Working Table on pages 141 to 173 of the Annexure – 4 to the Reply on behalf of the State of Karnataka to the Statement of the Case filed by the State of Goa, that at least 2828 million cubic feet (about 2.83 tmc) of water is earmarked for "Water supply for Drinking and other purposes on the downstream of the dam", which, perhaps, is in addition to 1080 million cubic feet (about 1.08 tmc) lifted directly from reservoir to be used for drinking water for twin cities of Hubli-Dharwad. This also needs to be

clarified, particularly in view of the fact that withdrawal of 1080 million cubic feet of water for twin city of Hubli-Dharwad has not been specifically reflected in the "Working Table of Malaprabha Project". There is also a mention of existing use of considerable quantum of water from Malaprabha dam for the domestic water supply for Hubli-Dharwad in Annexure – 61 of the Statement of Claims on behalf of the State of Karnataka. It is stated in the Table-2 (History of Bulk Water Supply Schemes to Hubli-Dharwad) on page 10 of the Annexure – 61 (Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir) of the Statement of Claims on behalf of the State of Karnataka that Bulk Water Supply is being made from Malaprabha Dam for Hubli-Dharwad since 1983. It appears that 153.80 million liters of water per day is currently being supplied from

Malaprabha dam which is equivalent to about 56.14 million cubic meters or 1.98 tmc. Obviously, the above statements and related information in respect of existing utilization for drinking water purposes and additional projected demand present varying figures which need clarification.

c. In Para 13.2, page 92 of the Statement of Claims of Karnataka, it is mentioned that "the Kalasa Banduri project for diversion of 7.56 tmc consists of diversion of 3.56 tmc under Kalasa Nala diversion and diversion of 4 tmc under Bhandura Nala to augment the flows of Malaprabha rivers…….".

63

However, in Para 5, page 4 of the Annexure 65 [Revised Detailed Project Report (Bhandura DPR – 2012) of Bhandura Nala Diversion Scheme prepared in 2012] of the Statement of Claims of Karnataka, it is mentioned that "the average annual yield as per the above formulae are 85.9 Mcum, 76.7 Mcum and 79.5 Mcum respectively. The 75% dependable yield, as per KPCL formulae is 66.7 Mcum (2.40 TMC). The same is adopted for studies". The maximum estimate of average annual yield reported above is 85.9 Mcum which is equal to 3.03 tmc. Obviously the envisaged diversion of 4 tmc of water to Malaprabha project from Bhandura Nala does not appear to be feasible in view of the information included in the above mentioned report. Such inconsistencies in results of the analysis / information included in various documents are definitely not acceptable.

d. As per Annexure – 73 of the Statement of Claims of

Karnataka, Government of Karnataka envisages use of about 1.00 tmc for irrigation purposes in Mahadayi basin. However, it is mentioned at page 2 of Annexure – 68 (Volume-I) of Statement of Claims of Karnataka that "the topography is hilly with forest cover suitable for power development only". The two Annexures of the Statement of Claims of Karnataka present conflicting statements.

e. Annexure – 69 of the Statement of Claims of Karnataka includes detailed project report (DPR) in respect of Palna diversion scheme and Katla diversion scheme and pre-feasibility report (PFR) in respect of Diggi (Mara Nala and Bondeli) diversion

scheme and Viranjole (Pasal Nala 1 and Pasal Nala 2) diversion scheme. Analyses of the information included in the reports indicate that runoff factor (i.e. average annual yield / average annual rainfall in the catchment) is 0.51 for Viranjole diversion schemes, 0.67 for Palna and Katla diversion schemes and 0.80 for Diggi diversion schemes. From the information included in Annexure – 68 of the Statement of Claims of Karnataka, it is stated that the runoff factors for Kotni dam project and Bail Nadi diversion scheme are 0.89 and 0.97 which are very high and unusual. Relevant information are summarized in Table – 1. Such high variations in runoff factors for schemes in the same sub-basin and with similar rainfall patterns are unusual and may not be acceptable.

f. It is also observed that there are inconsistencies even in some basic data. For example, different values of total catchment area of the Mahadayi

basin including that of its tributaries in the State of Karnataka have been mentioned in different documents. Different figures of the catchment area of river Mahadayi and its tributaries in Karnataka stated in different documents are 375 km 2 in Para 8.2, page 73 of Statement of Claims of Karnataka, 375.11 km 2 in Para 4.1, page 4-1 of Annexure 8 (NEERI report of 1997 Volume I), 400.16 km 2 in Para 1.1.3 of Annexure 73, 412 km 2 in Karnataka's letter dated 30.3.2002 as quoted by Goa at Annexure 102 of Statement of Case of Goa, and 455 km 2 on page 6, Annexure 3 (Minutes of the discussions held on 2.7.1992) of the Statement of

Claims of Karnataka. This is undoubtedly an unacceptable situation.

6. Maharashtra has indicated in Para 2.4, page 18 of the Statement of Case that "the comparison with adjoining basin studied by Maharashtra Water and Irrigation Commission given vide para 1.4.2 reveals the Maharashtra's estimate of availability in Madovi basi n as 5770 M.Cum. Based on this estimate proportionate yield from Maharashtra territory on average annual basis will be 218 M.Cum". Maharashtra has not projected the specific value of yield of catchment area of Mandovi / Mahadayi river basin in Maharashtra at 75% dependability. Against the projection of 218 Mm 3 of average annual yield from catchment area of Mandovi / Mahadayi in Maharashtra, total water requirement of 180 Mm 3 has been projected in Para 3.5.2, page 25 of the Statement of Case. In this regard, some important facts stated are as under.

a. In Para 2.5, page 18 of the Statement of Case filed by

Maharashtra on 2.1.2013, it is mentioned that "the detailed hydrology is under study by the Chief Engineer, Planning and Hydrology, Nashik and on getting the report the same will be submitted to the Hon'ble Tribunal". Maharashtra has filed Amended Statement of Case on 2. 4.2014. Para 2.5, page 15 of the Amended Statement of Case also mentions that "the detailed hydrology is under study by the Chief Engineer, Planning and Hydrology, Nashik and on getting the report the same will be submitted to the Hon'ble Tribunal". <u>It is apparent that the studies</u>

undertaken which were reported under progress in January 2013 by Government of Maharashtra have not been completed so far. Further, Maharashtra has not indicated any time frame for completion of the studies even in the Amended Statement of Case filed on 2.4.2014.

b. The projection of the water requirement of 180 Mm 3 includes irrigation needs of Maharashtra, drinking water needs in parts of Mandovi river basin, drinking water needs in adjoining uncommanded area of Tilari basin, industrial water needs in part of Mandovi river basin, industrial water needs in adjoining uncommanded area of Tilari basin, provision for future development and evaporation losses at the rate of 10%. The projection of water demand without properly assessing the water availability at different dependability i.e., 75% dependability (for irrigation purposes) and 100% dependability (for drinking water purposes) cannot be considered appropriate.

7. In addition, some general deficiencies in the pleadings of the parties, are noticed as under:

a. Apparently, both Goa and Maharashtra have referred to the same report i.e., the report of the Task Force to prepare the economic development plan for Goa State under the chairmanship of Dr. Swaminathan constituted by the Planning Commission in May 1981. However, two different figures of the average water availability from the basin have been quoted. In the Statement of Case of Goa, it is mentioned in Para 177, page 128- 129 that "… They assessed the average

annual yield of the entire Mahadayi River basin (i.e. including water resources generated but neither conservable useable quantity from the estuarine lower reach es) as 3580 MCM (126 tmc).” On the other hand, Maharashtra has quoted the average water availability as 4455 Mm 3 in Para 2.2.1, page 15-16 of Statement of Case of Maharashtra wherein, it is stated that “… In their published report in 1982 the Central Water Commission estimated the average annual yield of Mandovi Basin, including the yield from the basin areas lying in Maharashtra and Karnataka as 4455 Mm 3 ”. Interestingly, copy of the report referred to in Statement of Cases has not been filed by any of the two States .

b. All the three co-basin States have highlighted the highly varying hydro-meteorological characteristics and physiographic features from lower reaches to upper reaches of the basin. In its Statement of Case, Goa has mentioned in Para 180, page 13 6 that “Both

Karnataka's & Maharashtra's portion of the Mahadayi river basin areas are in the initial and head reaches of the river in the rugged areas of Western Ghats. Comparatively, the rainfall in these head reaches of Mahadayi River and its tributaries are much higher than in the middle and coastal reaches of the basin in Goa State. The rugged areas in head reaches of Mahadayi basin in Karnataka and Maharashtra State have thick forest and scant area for irrigation and sparse population. …".

Maharashtra in Para 1.1.6, page 6 of Statement of Case has observed that "… the stream or the river originating in the State of Maharashtra and

Karnataka have fairly steep slopes as most of the rivers originate in the Sahyadri hill ranges and rivers originating in the State of Goa have fairly flatter gradient indicating that they are draining comparatively plateau area". Agro -climatic variations have also been highlighted in details in Para 1.2.4, page 8-9 of Statement of Case of Maharashtra. Specific observations about the physiographical features of Mahadayi basin and its hydro-meteorological characteristics are indicated in Annexure 8 (NEERI report of 1997 Volume I) of Statement of Claims of Karnataka. In Para 4.2.1, page 4-1 of Annexure 8 of Statement of Claims of Karnataka, it is mentioned that the Mahadayi (Mandovi) basin is bounded on the north by Chapora basin, on the north-east by Kalinadi basin, on the south by Zuari basin and on the west by the Arabian Sea and that the Mahadayi basin can be broadly divided into three distinct sub-regions namely (i)

regions with undulating up-lands and hills, (ii) the coastal plains, and (iii) the intermediate or transitory regions. It is further stated in Para 4.3.2, page 4-15 of Annexure 8 of Statement of Claims of Karnataka that "..the bulk of the total annual rainfall occurs during the monsoon season i.e. from June to October. The distribution of rainfall is largely influenced by the topography of the area".

Such variations in physiographic features of the basin and hydro-meteorological characteristics of the region, which are duly recognized by all three States,

are bound to impact the process of runoff formation. However, it appears that these feature have not been duly reflected in the process for assessment of yield from the basin at different points in the reports by any of the States.

8. From above, it is apparent that many of the information's provided by the States through various documents are inconsistent and / or incomplete. Obviously, information made available by the party States in its present form cannot be made the basis of meaningful determination of arriving at reasonable assessment of the available water resources and judicious allocation of share of waters among the various stakeholders and for different purposes.

T ABLE – 1: SALIENT FEATURES OF PROJECTS PROPOSED BY KARNATAKA IN

DEVELOPMENT

MAHADAYI

BASIN

FOR

HYDROPOWER

Sl. No.	*Project*	*Catch-ment Area 2 (km)*	*Aver-age Rainfall (mm)*	*Average yield*		*RO factor*	*Reference and Remarks (if any)*
				3 Mm	*tmc*		
Projects for diversion of water to Kali Nadi for hydropower development							
1.	*Palna*	*6.40*	*6394*	*27.30*	*0.96*	*0.67*	*Page ii of DPR of Katla & Palna Diversion Scheme, Annexure – 69 of Statement of Claims of Karnataka*
2.	*Katla*	*16.10*	*6394*	*68.70*	*2.43*	*0.67*	

3.	*Diggi dam - Mara Nala*	*5.20*	*6000*	*25.00*	*0.88*	*0.80*	*Page 1 of PFR of Diggi Diversion Scheme, Annexure – 69*
4.	*Diggi dam – Bondeli*	*10.40*	*6000*	*49.92*	*1.76*	*0.80*	
5.	*Viranjole dam – Pasal Nala 1*	*6.20*	*6000*	*19.00*	*0.67*	*0.51*	*Page 1 of PFR of Virangole Diversion Scheme, Annexure – 69*
6.	*Viranjole dam – Pasal Nala 2*	*3.30*	*6000*	*10.00*	*0.35*	*0.51*	
Projects for hydropower development in Mahadayi basin							
7.	*Kotni dam*	*92.15*	*4947*	*405.23*	*14.31*	*0.89*	*Pages 4 to 6 of DPR of Mahadayi Hydro-electric Project, Annexure – 68 (Volume-*
8.	*Pansheer Nala diversion*	*6.50*	*-*	*27.69*	*0.98*	*-*	
9.	*Murudhuhaul Nala diversion*	*3.3*	*-*	*19.95*	*0.70*	*-*	
	Bail Nadi						

10.	*diversion*	*31.90*	*5800*	*178.86*	*6.32*	*0.97*	*I) of Statement of claims of Karnataka*
11.	*Andher Nala diversion*	*4.80*	*-*	*27.67*	*0.98*	*-*	
12.	*Irti dam*	*18.70*	*-*	*82.94*	*2.93*	*-*	

2. This Tribunal has been constituted in exercise of the powers conferred by Sub-section (1) of SECTION 5 of the Inter-State River Water Disputes Act 1956 (33 of 1956). Therefore, the Tribunal will have to go by the provisions of the said Act.

3. SECTIONS 9(1), 9(2) and 9A of the Inter-State River Water Disputes Act read as under:

“9(1). The Tribunal sh all have the same powers as are vested in a Civil Court under the Code of Civil Procedure, 1908, in respect of the following matters, namely:-

(a) ……..

(b) ……..

(ba) requisitioning of any data, as may be required by it.

(c) ……..

(2) The Tribunal may require any State Government to carry out, or permit to be carried out, such surveys and investigation as may be considered necessary for the adjudication of any water dispute pending before it.

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9A. (1) The Central Government shall maintain a data bank and information system at the national level for each river basin which shall include data regarding water resources, land, agriculture, and matters relating thereto, as the

Central Government may prescribe from time to time. The State Government shall supply the data to the Central Government or to an agency appointed by the Central Government for the purpose, as and when required.

(2) The Central Government shall have powers to verify the data supplied by the State Government, and appoint any person or persons for the purpose and take such measures as it may consider necessary. The person or persons so appointed shall have the powers to summon such records and information from the concerned State Government as are considered necessary to discharge their functions under this section."

4. In view of the important issues highlighted in the "Brief Note on Inconsistencies in Data/Information related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case/Statement of Claims and Related Documents" ("Brief Note", for short), which have been brought to the notice of the learned counsels representing the three States and in view of the consensus about some data/information in various documents being inconsistent and/or incomplete, the Tribunal proposes to exercise the powers conferred on it by SECTIONs 9(1)(ba), 9(2) and 9A of the Act and give directions to the three party States as well as the Central Government, with a view to secure required material, data as well as carry out surveys and investigations and to produce relevant data before it to enable the Tribunal to decide the two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stake holders, which have been highlighted in the "Brief Note".

(1)

The State of Goa is directed to submit its case of quantification of useful and reliable yield available in Mandovi Basin before the Tribunal for its perusal and decision in due course, on or before 2.12.2014.

The State of Goa is directed to complete the process already undertaken by it for more detailed studies and preparing individual Details Project Reports (DPRs) relating to the irrigation schemes in order to arrive at revised quantum of long term water requirements, on or before 2.12.2014.

(2)

73

(3)

The State of Goa is directed to produce before this Tribunal the hydrological data in its possession, on or before 2.12.2014.

The State of Goa is directed to undertake detailed analysis with a view to checking the consistency of data and file reports based on those findings, on or before 2.12.2014.

The State of Goa is directed to inspect all the documents produced by the State of Karnataka before the Krishna Water Disputes Tribunal on or before 2.12.2014 and commit firmly whether it proposes to rely upon the documents produced before the Krishna Water Disputes Tribunal or not. Failure on the part of the State of Goa will forfeit its right to inspect the documents produced before the Krishna Water Disputes Tribunal and to rely upon the same before this Tribunal.

The State of Goa is directed to compare the

physiographical features of the basin and hydro-meteorological characteristics of the region with the data given by the State of Karnataka and the State of Maharashtra and state before this Tribunal about the correct assessment of yield from the basin at different points with due consideration to the physiographical features and hydro-matereological characteristics of the region, on or before 2.12.2014.

The State of Goa is directed to produce before the Tribunal the report of the Task Force to prepare the

(4)

(5)

(6)

(7)

economic development plan for the State of Goa under the Chairmanship of Dr. Swaminathan constituted by the Planning Commission in May 1981, on or before 2.12.2014.

(8)

The State of Karnataka is directed to commit firmly before this Tribunal its case about water availability after cross checking the details which have been pointed out in the “Brief Note”, on or before 2.12.2014.

The State of Karnataka is directed to state its case clearly before the Tribunal as to how much water it proposes to utilize for diversion under Kalasa Bhanduri as well as for irrigation, drinking purposes and other purposes within the Mahadayi Basin and proposes to divert how much quantity of water to Kalinadi to augment the flows for power generation under the KHEP and also how much quantity of water is available at present under the MHEP for power generation, on or before 2.12.2014.

(9)

(10) The State of Karnataka is directed to submit before the Tribunal as to what is the exact requirement of drinking water for the twin cities of Hubli-Dharwad, in view of the inconsistencies which have been pointed out in detail in the “Brief Note”, on or before 2.12.2014.

(11) The State of Karnataka is directed to produce data before this Tribunal as to on what basis the water availability from Malaprabha river was assessed and on what basis same was revised later on, on or before 2.12.2014.

(12) The State of Karnataka is directed to commit firmly before this Tribunal as to whether 2828 million cubic feet of water earmarked for water supply for drinking and other purposes on the downstream of the dam is or is not in addition to 1080 million cubic feet lifted directly from reservoir to be used for drinking purposes for twin cities of Hubli-Dharwad, on or before 2.12.2014.

(13) The State of Karnataka is directed to state before the Tribunal as to whether the Kalasa-Bhanduri Project for diversion of 7.56 tmc consists of diversion of 3.56 tmc under Kalasa Nala diversion and diversion of 4 tmc under Bhanduri Nala to augment the flows of Malaprabha river or the diversion of 4 tmc of water to Malaprabha Project from Bhanduri Nala is not feasible at all in view of the contents of the revised detailed project report of Bhanduri Nala Diversion Scheme prepared in 2012, on or before 2.12.2014.

(14) The State of Karnataka is directed to produce before

this Tribunal the data/information, including the observed hydrological data in its possession, on or before 2.12.2014.

(15) The State of Karnataka is directed to undertake a detailed analysis with a view to checking the consistency data and file reports on findings of the analysis, on or before 2.12.2014.

(16) The State of Karnataka is directed to compare the physiographical features of the basin and hydro-meteorological characteristics of the region with the data given by the State of Goa and the State of Maharashtra and state before this Tribunal about the correct assessment of yield from the basin at different points with due consideration to the physiographical features and hydro-metereological characteristics of the region, on or before 2.12.2014.

(17) The State of Maharashtra is directed to complete the detailed hydrological study undertaken by the Chief Engineer, Planning and Hydrology, Nashik as early as possible and produce report of the same before the Tribunal, on or before 2.12.2014.

(18) The State of Maharashtra is directed to commit firmly before the Tribunal the water availability at different dependability i.e. 75% to be used for planning for irrigation purposes and 100% dependability to be used for planning for drinking purposes, on or before

2.12.2014.

(19) The State of Maharashtra is directed to produce before the Tribunal the report of the Task Force, for the purpose of preparation of the economic development plan under the Chairmanship of Dr. Swaminathan constituted by the Planning Commission in May 1981, which it has utilized for projection of water availability and compare the same with the observations of the State of Goa and assess the average annual yield of the entire Mahadayi River Basin by the State of Goa and

state before the Tribunal as to what is its stand about the average availability of water from Mahadayi Basin, on or before 2.12.2014.

(20) The State of Maharashtra is directed to compare the physiographical features of the basin and hydro-meteorological characteristics of the region with the data given by the State of Goa and the State of Karnataka and state before this Tribunal about the correct assessment of yield from the basin with due consideration to the physiographical features and hydro-matereological characteristics at different points, on or before 2.12.2014.

(21) The State of Maharashtra is directed to produce before the Tribunal the hydrological data in its possession, on or before 2.12.2014.

6. The Tribunal is informed by the learned counsel for the parties that the duties contemplated by SECTION 9A of the Act are being performed by the Central Water Commission, which is an attached office of the Ministry of

Water Resources of the Central Government. Therefore, the following directions are issued to the Central Water Commission:

(22) The Central Water Commission is directed to furnish all available data/information relating to planning and development of water resources of Mahadayi River Basin, particularly the discharge data from the hydrological observation stations of Central Water

Commission on River Mahadayi and its tributaries to the three co-basin States viz. State of Goa, State of Karnataka and the State of Maharashtra, on or before 2.12.2014.

(23) The Central Water Commission is directed to undertake a detailed analysis with a view to checking consistency of data and file report on findings of the analysis before this Tribunal on or before 2.12.2014.

(24) The issues in the matter arising for adjudication were determined on the basis that the pleadings were complete. However, the Tribunal finds that two States out of three States which are before it have amended their respective Statement of Cases, to which replies have been filed and rejoinders are also filed. Today, one application is moved by the State of Karnataka seeking permission of the Tribunal to amend its pleadings. If that application is allowed, the respondents will seek time to file replies and the State of Karnataka may file rejoinder to the replies. Thus the Tribunal has not

reached the stage of completion of pleadings. The directions given if complied with would result into further amendment of the pleadings of the parties. Further, the amendments of the pleadings of the parties would necessarily result into amendment of the issues already raised for determination. Therefore, it is clarified that if any of the States fails to comply with the directions given by the present order, the Tribunal will be left with no option but to draw adverse inference against the State concerned, as may be permissible under the law. It is also made clear that failure to comply with the directions would forfeit the right of the

State concerned to produce data and/or rely upon the information, studies undertaken, inspection of the documents to be taken, etc. and thereafter, the Tribunal will not look into such evidence at all, even if produced at later stage by any of the States.

6. List the matter for further hearing on 9.12.2014.

Though the matter is adjourned to 9.12.2014, the States concerned must be ready with necessary applications for the amendment of their respective Statements of Case/Claims, etc. on the basis of the data/information, which would be available to the State concerned pursuant to the directions given today by this order, so that the applications for amendment of the pleadings, if any, be taken up for consideration on 9.12.2014."

ORDER DATED 15.04.2015 PASSED BY THE TRIBUNAL IN I.A. NO. 29 OF 2014 PERMITTING THE STATE OF KARNATAKA TO WITHDRAW ITS APPLICATION FOR AMENDMENT OF ITS STATEMENT OF CLAIM

20.

Meanwhile, State of Karnataka had filed I. A. No. 29/2014 seeking permission of the Tribunal to permit it to amend its Statement of Claim. By Order dated 03.09.2014 the said application was adjourned. I. A. No. 29/2014 was, thereafter, taken up for hearing on 11.02.2015 and in view of the request of the learned Counsel for the State of Karnataka, the said application was adjourned to 15.04.2015. On 15.04.2015, I. A.

80

No. 29/2014, filed by the State of Karnataka, seeking permission of the Tribunal to permit it to amend its Statement of Case was withdrawn. The said application was, accordingly, disposed of.

DETAILS OF FURTHER AMENDMENTS OF THEIR RESPECTIVE STATEMENT OF CASES/CLAIMS BY THE THREE PARTY-STATES AS WELL AS THE REPLIES AND REJOINDERS THERETO.

21.

The issues in the matter arising for adjudication were determined on the basis that the pleadings were complete. However, the Tribunal found that the two States out of the three States which are before the Tribunal, had amended their respective Statement of cases to which replies were also filed and Rejoinders were also filed. On September 3, 2014, one application was moved by the State of Karnataka seeking permission of the Tribunal to amend its pleadings. It was felt that if that application was allowed, the respondents would seek time to file replies and the State of Karnataka would seek time to file rejoinder to the replies. It was noticed that the Tribunal had not reached the stage of completion of the pleadings. The directions

given on September 3, 2014, if complied with, would have resulted into further amendments of the pleadings of the parties. Further, the amendments of the pleadings of the parties would

necessarily result into amendments of the issues already raised for determination. Therefore, it was clarified that if any of the States failed to comply with the directions given by the Tribunal vide Order dated September 3, 2014, the Tribunal would be left with no option but to draw adverse inference against the State concerned as would be permissible under the Law. It was made clear to the States that failure to comply with the directions would forfeit the right of the State concerned to produce data and/or rely upon the information, the study undertaken, inspection of the documents to be taken etc., and that thereafter, the Tribunal would not look into such evidence even if it was produced at a later stage by any of the States.

22.

Pursuant to the above mentioned detailed Order, State of Goa further amended its Statement of Case on April 23, 2015 (Volume 131). The State of Karnataka filed its para-wise reply dated May 25, 2015 (Volume 138), to the said further amended Statement of Case of State of Goa. Similarly, the State of Maharashtra filed its reply dated April 29, 2015 (Volume 133)

to the said further amended Statement of Case filed by the State of Goa on April 23, 2015.

82

On receipt of the above mentioned replies, the State of Goa filed Rejoinder dated June 30, 2015 to the reply filed by the State of Karnataka on May 25, 2015 (Volume 150). The State of Goa also filed Rejoinder dated June 30, 2015 (Volume 148) to the additional reply filed by the State of Maharashtra on May 11, 2015.

23.

After passing of detailed Order dated September 3, 2014, which is referred to earlier, the State of Karnataka filed its amended Statement of Claims on April 20, 2015 (Volume 129). The State of Goa filed its reply dated May 5, 2015 (Volume 134) to the said amended Statement of Claims filed by the State of Karnataka on April, 20, 2015, whereas the State of Maharashtra filed reply dated April 29, 2015 (Volume 133) to the said amended Statement of Claims of the State of Karnataka.

After receipt of the above mentioned replies from the State of Goa and the State of Maharashtra, the State of Karnataka filed full Rejoinder dated June 23, 2015 (Volume 144), which was filed on June 24, 2015, to the replies dated May 14, 2013 and May 5,

2015, filed by the State of Goa, to the Statements of Claims of the State of Karnataka dated January 2, 2013, and April 17, 2015,

respectively. The State of Karnataka also filed Rejoinder dated June 23, 2015, which was filed on June 24, 2015 (Volume 142) to the reply dated April 29, 2015, filed by the State of Maharashtra, to the amended Statement of Claims of State of Karnataka.

24.

Again, the State of Maharashtra had filed further amended Statement of Case dated April 20, 2015 (Volume 127), to which additional reply was filed by the State of Goa on May 5, 2015 (Volume 135). The State of Karnataka had also filed reply dated June 12, 2015 (Volume 140), to the further amended Statement of Case filed by the State of Maharashtra on April 20, 2015.

On receipt of the above mentioned replies, the State of Maharashtra had filed additional Rejoinder dated June 29, 2015 (Volume 146), to the additional reply filed by the State of Goa, to the further amended Statement of Case of Maharashtra.

Similarly, the State of Maharashtra had filed Rejoinder dated June 29, 2015 (Volume 145), to the reply filed by the State of Karnataka, to the further amended Statement of Case filed by the

State of Maharashtra.

84

ORDER DATED 06.05.2015 PASSED BY THE TRIBUNAL IN I.A. NO. 28 OF 2014 FILED BY THE STATE OF GOA DIRECTING THE STATE OF MAHARASHTRA NOT TO UNDERTAKE, COMMENCE THE WORK OF GORGE PORTION OF VIRDI DAM.

25.

The State of Goa had filed I.A.No. 28 of 2014 on June, 6, 2014, and claimed following reliefs:-

"a) Pass an order restraining the State of Maharashtra from proceeding with any planning, construction and water regulation of any projects in the Mandovi River Basin including its tributaries involving trans-basin diversion of waters until the inter- State disputes are adjudicated by this Hon'ble Tribunal; and

b) That the Tribunal be pleased to declare that the works undertaken by the State of Maharashtra in relation to the Virdi Large Minor Irrigation Project including the canals and dams built to divert the waters of River Mhadei and its tributaries is illegal and

this Tribunal be further pleased to direct the State of Maharashtra not to go ahead with any work and to maintain complete status quo till the matter is resolved by this Hon'ble Tribunal.

c) That this Tribunal be pleased to pass an Order of Mandatory Injunction directing the State of Maharashtra to freeze their present upstream use at

the declared levels and undertake not to permit any intervention that amounts to upstream use of the waters of River Mhadei;

d) That this Hon'ble Tribunal be pleased to pa ss an Order commanding the state of Maharashtra to divulge the complete information regarding the Virdi Large Minor Irrigation Project including the present plan of change of the site and size of the said Project;

e) Pass such further orders as this Hon'b le Tribunal may deem fit and proper in the circumstances of the case."

The said application was taken up for final disposal on May 06, 2015 and the following Order was passed:

"5. In view of the undertaking given by the learned counsel for the State of Maharashtra, it is directed that the State of Maharashtra shall not undertake/commence the work of filling of the gorge portion of Virdi Dam at Kattika Nallah until the final adjudication of the disputes by this Tribunal. As the

State of Maharashtra has voluntarily decided not to proceed with the components of Virdi Project that were required for the trans-basin diversion of water to Tillari Basin until the adjudication of the controversy by this Tribunal, it is hereby directed that the State of Maharashtra shall not undertake any works that would enable the State of Maharashtra to

86

divert the water of Mahadayi outside the basin of the said river till the adjudication of the disputes by this Tribunal.

6. The instant application – I.A. No. 28 of 2014 – accordingly stands finally disposed of."

26. The reliefs sought by the three party States in their respective Statement of Claims/Amended Statement of Claims/Further Amended Statement of Claims, are detailed in the following paragraphs.

PRAYERS OF THE STATE OF GOA

27. In para 225 of the Statement of Case filed by the State of Goa on February 4, 2013 (Volume 28), the following prayers

have been claimed: -

“225. In the light of the aforesaid facts and circumstances, the State of Goa prays for the following reliefs: -

PRAYERS

(A) That this Hon’ble Tribunal be please to declare that the State of Karnataka and the State of Maharashtra does not have any right, authority or power to divert the waters

of River Mahadayi outside the River Basin, without the concurrence of the State of Goa.

(B) That this Hon’ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra by way of a Permanent Injunction to forthwith stop implementation/construction of all or any Projects in the Mahadayi Main Basin/upon Mahadayi River, including, but not restricted to the Kalsa-Haltar Project; Bhandura Project and any other Project involving trans- basin transfer of waters, i.e. transfer of waters outside the Mahadayi River basin;

(C) Without prejudice to the prayer clauses (A) and (B) above and in the alternative,

(i) That this Hon'ble Tribunal be pleased to determine the true and correct principles applicable for equitable use of waters from the Mahadayi River basin/Mahadayi River and1ssue appropriate directions in that regard;

(ii) That this Hon'ble Tribunal be pleased to determine the share of all the riparian States on the remainder waters

of Mahadayi River, if any available, after assessing and deducting the same from the available waters of Mahadayi River, the water requirement of ecological sustenance of the River valley eternally, specifically giving' due consideration of the scientifically predicted global warming, sea level Increase, increased salinity ingress in coastal areas, etc.;

(D) That this Hon'ble Tribunal be pleased to make such orders as to the costs a s it appears to be just and proper.”

88

28.

In para 225 of the amended Statement of Case filed by the State of Goa on March 7, 2014 (Volume 65), the following prayers have been claimed:

“225. In the light of the aforesaid facts and circumstances, the State of Goa prayed for the following reliefs:-

PRAYERS

(A) That this Hon’ble Tribunal be pleased to declare that the State of Karnataka and the State of Maharashtra does not have any right, authority or power to divert the waters of River Mahadayi outside the River Basin, without the concurrence of the State of Goa.

(B) That this Hon’ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra by way of a Permanent Injunction to forthwith stop implementation/construction of all or any Projects in the Mahadayi Main Basin/upon Mahadayi River, including, but not restricted to the Kalsa-Haltar Project; Bhandura Project and any other Project involving trans-basin transfer of

waters, i.e. transfer of waters outside the Mahadayi River basin.

(B1) That this Hon’ble Tribunal be pleased to declare that the works undertaken by the State of Karnataka in relation to the Kalasa Bandura Project including the canals and dams built to divert the waters of River Mhadei is illegal and this

Tribunal be further pleased to direct demolition of the said canals.

(B2) That this Hon ble Tribunal be pleased to pass an Order of Mandatory Injunction directing the State of Karnataka and State of Maharashtra to freeze their present upstream use at the declared levels and undertake not to permit any intervention that amounts to upstream use· of the waters of River Mhadei;

(C) Without prejudice to the prayer clauses (A),(B)(Bl) and (B2) above and in the alternative,

(i) That this Hon’ble Tribunal be pleased t o determine the true and correct principles applicable for equitable use of waters from the Mahadayi River basin/ Mahadayi River and Issue appropriate directions in that regard;

(ii) That this Hon'ble Tribunal be pleased to determine the share of all the riparian States on the remainder waters of Mahadayi River, if any available, after assessing and deducting the same from the available waters of Mahadayi River, the water requirement of ecological

sustenance of the River valley eternally, specifically giving due consideration of the scientifically predicted global warming, sea level increase, increased salinity ingress in coastal areas, etc.;

(iii) That this Hon'ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra to declare their present upstream use including use by Rainwater Harvesting and such use may be counted against the share of State of Karnataka and State of Maharashtra.

(D) That this Hon'ble Tribunal be pleased to make such orders as to the costs as it appears to be just and proper."

29.

In para 225 of the amended Statement of the Case filed on March 24, 2015 (Volume 131), the State of Goa has claimed the following reliefs:-

"225. In the light of the aforesaid facts and circumstances, the State of Goa has claimed for the following reliefs:-

PRAYERS

(A) That this Hon'ble Tribunal be please to declare that the State of Karnataka and the State of Maharashtra does not have any right, authority or power to divert the waters of River Mahadayi outside the River Basin, without the concurrence of the State of Goa.

(B) That this Hon'ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra by way of a Permanent Injunction to forthwith stop implementation/construction of all or any Projects in the Mahadayi Main Basin/upon Mahadayi River, including, but

not restricted to the Kalsa-Haltar Project; Bhandura Project and any other Project involving trans-basin transfer of waters, i.e. transfer of waters outside the Mahadayi River basin;

(B2) That t his Hon’ble Tribunal be pleased to declare that the works undertaken by the State of Karnataka in relation to the Kalasa Bhandura Project including the canals and

dams built to divert the waters of River Mhadei is illegal and this Tribunal be further pleased to direct demolition of the said canals.

(B3) That this Hon'ble Tribunal be pleased to pass an Order of Mandatory Injunction directing the State of Karnataka and State of Maharashtra to freeze their present upstream use at the declared levels and undertake not to permit any intervention that amounts to upstream use of the waters of River Mhadei;

(C) Without prejudice to the prayer clauses (A) and (B) above and in the alternative,

(i) That this Hon'ble Tribunal be pleased to determine the true and correct principles applicable for equitable use of waters from the Mahadayi River basin/Mahadayi River and issue appropriate directions in that regard;

(ii) That this Hon'ble Tribunal be pleased to determine the share of all the riparian States on the remainder waters of Mahadayi River, if any available, after assessing and deducting the same from the available waters of

Mahadayi River, the water requirement of ecological sustenance of the River valley eternally, specifically scientifically predicted global warming, sea level increase, increased salinity ingress in coastal areas, etc.;

(iii) That this Hon'ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra to declare their present upstream use including use by Rainwater Harvesting and such use may be counted against the share of State of Karnataka and State of Maharashtra.

92

(D) That this Hon’ble Tribunal be pleased to make such orders as to the costs as it appears to be j ust and proper.”

PRAYERS OF THE STATE OF KARNATAKA

30.

In CHAPTER V RELIEF of Statement of Claims filed by the State of Karnataka on January 2, 2013 (Volume 10), the following reliefs have been claimed:-

“ 17.1 Under the above circumstances, and having regard to the requirements of justice and equality, the State of Karnataka humbly prays before this Hon’ble Tribunal to:

(i) Hold that Karnataka’s share in the waters of inter - State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilisation;

(ii) Hold that Karnataka is entitled to divert out of its own equitable share for consumptive utilisation;

(a) 7.56 tmc to provide drinking water to Hubli-Dharwad cities under the Kalasa-Bhandura nala projects;

(b) 5.527 tmc to Kali basin to augment the flows of Kali

for hydro-power generation under Kali Hydro-

Electric Project (KHEP);

93

(c) Remaining water for generation of power under Mahadayi Hydro-Electric Project (MHEP) at Kotni;

and

(iii) Hold that Goa has failed to establish that it is or is likely to be affected prejudicially by the diversion of waters of inter-State river Mahadayi and its valley as proposed by Karnataka. ”

31.

In CHAPTER, RELIEF of the amended Statement of Claims filed by the State of Karnataka on April 20, 2015 (Volume 129), the following prayers have been claimed:-

“ 17.1 Under the above circumstances, and having regard to the requirements of justice and equality, the State of Karnataka humbly prays before this Hon’bl e Tribunal to:

(i) Hold that Karnataka’s shar e in the waters of inter State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilisation;

(ii) Hold that Karnataka is entitled to divert out of its own equitable share for consumptive utilisation:

(a) 7.56 tmc to provide drinking water to Hubli-Dharwad cities under the Kalasa-Bhandura nala projects;

(b) 5.527 tmc to Kali basin to augment the flows of Kali for hydro-power generation under Kali Hydro-Electric Project (KHEP);

(c) Remaining water for generation of power under Mahadayi Hydro-Electric Poject (MHEP) at Kotni;

and

(iii) Hold that Goa has failed to establish that it is or is likely to be affected prejudicially by the diversion of waters of inter-State river Mahadayi and its valley as proposed by Karnataka.

(iv) Allocate 1.5 tmc for irrigation, drinking purposes and other purposes within the Mahadayi basin of Karnataka.

(v)

Declare that the surplus water available in Mahadayi basin at the proposed Kotni dam site is 7 tmc at 75% dependability.

(vi) allocate 7 tmc of surplus water available in Mahadayi basin at the proposed Kotni dam site for utilisation in

Malaprabha basin under the following three projects/schemes:

a. 3.00 tmc of water is to be utilized for protective irrigation in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas by Lift Schemes.

b. 2.00 tmc of water is to be utilized for drinking water and irrigation by recharge of ground Water in the

95

DPAP areas of Ramdurga, Soundatti and Bailhongal Talukas.

c. 2.00 tmc of water is to be utilized for areas in Malaprabha Command, which are not getting adequate water as planned.

(vii) Pass any other Order or Orders as this Hon'ble Tribunal deems fit in the interest of justice and equity. "

PRAYERS OF THE STATE OF MAHARASHTRA

32.

In CHAPTER 6 of Statement of Case filed by the State of Maharashtra on January 2, 2013 (Volume 27), the following prayers have been sought:-

" The State of Maharashtra having set out its case in Chapters 1 to 5 prays:

(a)

That this Hon'ble Tribunal be plea sed to determine the total availability of waters in the Mandovi River basin and further decide at what dependability (75% or average) it should be distributed between the

parties.

That this Hon’ble Tribunal be pleased to determine the share of each State on equitable appointment of water of the Inter State River Mandovi.

(b)

96

(c)

That this Hon’ble Tribunal be pleased to allocate 180.00 Mcum water to the State of Maharashtra.

That this Hon’ ble Tribunal be pleased to determine the share of Maharashtra State as a result of augmentation of waters in Krishna basin in accordance with the KWDT Award.

That this Hon’ble Tribunal be pleased to determine the share of Maharashtra State in the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of water to Kali Hydro Power Project.

That this Hon’ble Tribunal may make such order as to costs as it may appear to be just and proper. ”

(d)

(e)

(f)

33.

In Chapter 6 of the amended Statement of Case filed

by the State of Maharashtra on April 2, 2014 (Volume 74), the following prayers have been claimed:

“ The State of Maharashtra having set out its case in Chapters 1 to 5 prays:

a)

That this Hon’ble Tribunal be pleased to determine the total availability of waters in the Mandovi River basin and further decide at what dependability (75%

or average) it should be distributed between the parties.

b)

That this Hon’ble Tribunal be pleased to determine the share of each State on equitable apportionment of water of the Inter State River Mandovi.

That this Hon’ble Tribunal be pleased to allocate 180.00 Mcum water to the State of Maharashtra.

That this Hon’ble Tribunal be pleased to determine the share of Maharashtra State as a result of augmentation of waters in Krishna basin in accordance with the KWDT Award.

That this Hon’ble Tribunal be pleased to determine the share of Maharashtra State in the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of water to Kali Hydro Power Project.

c)

d)

e)

(ea) That in the event of trans-basin diversion being allowed to the State of Karnataka, this Hon'ble Tribunal may be pleased to direct the State of Karnataka to maintain minimum flows in Haltara nalla in the post monsoon period so that the sustenance of the inhabitants, flora and fauna in the State of Maharashtra is not jeopardized.

f)

That this Hon'ble Tribunal may make such order as t o costs as it may appear to be just and proper.

98

34.

In Chapter 6 of the further amended Statement of Case filed by the State of Maharashtra on April 20, 2015 (Volume 127), the State of Maharashtra has sought the following reliefs:-

a)

That this Hon'ble Tribunal be pleased to determine the total availability of waters in the Mandovi River basin and further decide at what dependability (75% or average) it should be distributed between the parties.

That this Hon'ble Tribunal be pleased to determine the share of each State on equitable apportionment of water of the Inter State River Mandovi.

That this Hon'ble Tribunal be pleased to allocate 180.00 Mcum water to the State of Maharashtra.

That this Hon'ble Tribunal be pleased to determine the share of Maharashtra State as a result of augmentation of waters in Krishna basin in accordance with the KWDT Award.

That this Hon’ble Tribunal be pleased to determine the share of Maharashtra State in the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of water to Kali Hydro Power Project.

b)

c)

d)

e)

(ea) That in the event of trans-basin diversion being allowed to the State of Karnataka, this Hon’ble Tribunal may

99

be pleased to direct the State of Karnataka to maintain minimum flows in Haltara nalla in the post monsoon period so that the sustenance of the inhabitants, flora and fauna in the State of Maharashtra is not jeopardized.

(f)

That this Hon'ble Tribunal may make such order as to costs as it may appear to be just.

In order to understand the scope, ambit, extent,

35.

sphere and limits of the prayers claimed by the three party States, it would be relevant to notice their pleadings in details.

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - II

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – II

Sl. No.	D E S C R I P T I O N	PAGE NOS
1.	Pleadings of the State of Goa	100 - 341

DETAILS OF THE PLEADINGS OF THE STATE OF GOA

36.

The entire case pleaded by the State of Goa, emerging from (1) its statement of case dated February 4, 2013 (Volume 28); (2) Rejoinder dated July 15, 2013 (Volume 45) to the reply filed by the State of Karnataka to the Statement of Case of the State of Goa; (3) Rejoinder dated July 15, 2013 (Volume 45) to the reply filed by the State of Maharashtra to the Statement of Case of the State of Goa; (4) The amended Statement of Case dated March 7, 2014 (Volume 65) filed by the State of Goa; (5)Rejoinder dated April 16, 2014 (Volume 77) filed by the State of Goa to the reply filed by the State of Karnataka to the amended Statement of Case of the State of Goa; (6) Rejoinder filed by the State of Goa on March 3, 2014 (Volume 73A), to the reply filed by the State of Maharashtra, to the amended Statement of Case of the State of Goa; (7) Amended Statement of Case of the State of Goa filed on April 23, 2015 (Volume 131); (8) Rejoinder dated June 30, 2015 (Volume 150) filed by the State of Goa to the reply dated May 25, 2015 filed by the State of

Karnataka to the amended Statement of Case of State of Goa; and (9) Rejoinder dated June 30, 2015 (Volume 148) filed by the

State of Goa to the additional reply filed by the State of Maharashtra on May 11, 2015, is as under:-

(i)

According to the State of Goa, the present dispute is unlike any other inter-state River water dispute, which normally concerns sharing of waters between the states. It is maintained that the present dispute is not of that kind. It is pleaded by the State of Goa that the proposal in question of the state of Karnataka will result in a complete ecological disaster in which flora, fauna, hills, Ghats, Plains and predominant marine life, including mangroves and other species, which are alleged to be rare and protected, would be completely destroyed.

It is maintained that Goa is a beautiful State blessed with rich flora, fauna, tourism potential and thus, it is maintained that, in that sense, ‘this dispute is of national importance’.

(ii)

It is maintained by the State of Goa that a reference has to be made to certain peculiar, historical, geographical, and

geological aspects, concerning the State of Goa, Mahadayi River, Mahadayi River Valley and Basin.

(iii) The State of Goa has pleaded that the Western Ghats are remarkable headwaters and the main watershed for the southern peninsula serving six States; sustained by the heavy seasonal rainfall from the south-west monsoon, from which all the major and many smaller rivers of the southern peninsula originate and flow east or west emptying into the coastal waters. It is averred that the real merit of the Western Ghats forests in terms of their watershed value is incalculable.

(iv) It is maintained that the State of Goa is the smallest of all the States in the country yet, it has a diversity of endemic species, habitats and ecosystems. It is mentioned that Goa is under the influence of two global biomes - the marine biome of the Arabian Sea and the terrestrial forest biome of the Western Ghats and within this balance there are a wide range of ecosystems and habitats e.g. forests, Ghats, alluvial plains, coasts, rivers, estuaries, mangroves, wetlands, etc.

(v)

It has been described in the pleadings that the State of Goa

has been divided into 4 physiographical sub-divisions by the Indian Council of Agricultural Resources, namely:

(a) Eastern hill ranges .The Western Ghats with continuous range of Sahayadri Hills forms the commencement of the high hill ranges of the East. The foot slopes of the range touch Ponda in Central Goa, Sattari in the North and almost the interior of Canacona in the South.

(b) Central rolling to undulating uplands .The central part of Goa from North to South connecting Pernem, Bicholim, Ponda and Eastern parts of Sanguem and Dharbandora and Quepem are occupied by undulating uplands having gentle to moderate slopes, intercepted by depressional landscape comprising valleys.

(c)

Flood plains .The flood plains are of the two major rivers, namely, Mandovi and Zuari, which divide the coastal plains and the rolling uplands in the East and South East. These are occupying talukas of Tiswadi, Ponda and Part of Salcete.

(d)

Coastal plains .The Western and South-Western parts

of Goa constitute the coastal plains.

(vi) According to the pleadings of the State, so far as the Mandovi (the Mahadayi) river is concerned, the same apart from being one of the most important west flowing rivers of

Goa, is virtually the lifeline for the very sustenance of the State of Goa and its peoples. It is mentioned that the Mandovi river basin is an inter-State river basin draining areas in the States of Goa, Karnataka and Maharashtra and the river drains a total area of approximately 2032 sq.km., spread over the three States in approximately the following proportions:

a.	Goa	=	1580 sq. km. (78%)
b.	Karnataka	=	375 sq. km. (18%)
c.	Maharashtra	=	77 sq. km. (4%)
Total Drainage		=	2032 sq. km. (100%)

The State of Goa has pleaded that this river rises in Jamboti Ghat, about 10 Kilometers North-East of Sonasagar near Degaon Village in Khanapur Taluka, Belgaum district of Karnataka State, at an elevation of about 940 meters above the mean sea level and the river basin lies between latitudes 15 0 15’24” N

and 15 0 42’00” N and longitudes

73 0 45’56” E and 74 0 23’54” E.

The State of Goa states that the length of River Mhadei within the State of Goa is 76 km. It is further stated that the length of the said River within the State of Karnataka is 35

km., and the total length of River Mhadei is 111 km. The State of Goa has further stated that as a result of the digitization of maps/plans, it is revealed that the length of the River up to which the salinity ingress impact is felt (i.e. up to Ganjem discharge measuring site) is 46 km. from the mouth of the river and there is a long established navigational network in the Mhadei River in the last reach of 46 km.

(vii)

It is pleaded that the Mahadayi River in Karnataka is joined by three important tributaries, namely the Bail Nadi, the Kotni Nadi and the Bhandura Nalla and there are five important tributaries forming the Madei/Mandovi river in Goa portion, namely Surla (or Nanode Nadi), the Ragda, the Dicholi, the Mapuca and the Khandepar (or the Dudhsagar). It is informed that a branch (spill channel) of the Mandovi, the Cumbarjua Canal, connects the Mandovi to the Zuari River in its final reach.

(viii) It is stated that the Mandovi river basin can geologically be broadly divided into four distinct sub-regions west to east, namely:

(i)

The coastal plains with dominant marine lands on the west.

(ii)

The vast etch plain adjoining the coastal plains.

(iii) Low dissected denudational hills and table land.

(iv) Deeply dissected high Western Ghat denudational hills.

(ix) It is submitted that the mountain ranges running parallel to India's west coast receive heavy rainfall and thus have an immense water resources potential. It is averred that the States of Maharashtra, Goa, Karnataka, and Kerala share the western coast and several rivers originate in the higher altitudes of Western Ghats and cascade down the steep slopes and pour out in to Arabian Sea. According to State of Goa because of the topography of the mountains, width of

all these basins is relatively small, and except two, all basins are within a State. It is stated that Mandovi and Netravati are the only two basins that are Inter-State and Mandovi is shared by three States, Goa, Karnataka, and Maharashtra,

while Netravati is shared by two States, Karnataka and Kerala.

It is submitted that the Mandovi River is a short length west flowing river on the West Coast of India. As per pleadings the main river originates in the Western Ghats of Karnataka, and runs for 35 km., in that state, before entering State of Goa, where in it flows for another 52 Km, before merging into Arabian Sea near Panaji. It is asserted that river basin of Mandovi River, occupies about 43% of the State of Goa.

(x)

According to the State of Goa, the Mandovi river basin, in the State of Goa, can be broadly sub-divided into three zones or sub-regions based upon geographical utility features:

(i)

The sub-region of about 530 sq.km., in the upper most region of river basin located in Goa (possible conservation zone).

(ii)

The downstream of the conservation zone is the drainage area of the Mandovi river basin admeasuring about 541 sq.km. at low altitudes above the sea level,

where most of the population is concentrated in this region (population/Industrial zone).

(iii) A stretch/sub-region of 509 sq.km., of basin area in its final reach is in salinity and very fragile river zone. This is the area/sub-region, where river meets the Arabian Sea (salinity affected zone).

(xi)

The State of Goa has pleaded that although, the drainage area of the basin within the State of Goa extends to approximately 1580 sq.km., it is neither possible, nor practicable to undertake any water conservation measures over the entire drainage area. According to the pleadings, the last stretch of 509 sq.km. (Salinity affected zone) is an environmentally fragile zone, primarily on account of the factors relating to high salinity and the eco-systems which develop with such salinity features. It is stated that besides, this stretch is used for navigation and means of access to the Panaji and Marmugao Ports and at present, salt water ingress and tidal influence is felt almost 36 Km

upstream beyond Ganjem and this corresponds to almost 69% of the river's length within the State of Goa. Thus, it maintains that in the event, there is any alteration of the

river profile by the States of Karnataka and Maharashtra, then the same will result in drastic reduction in fresh water flow. It is further maintained that such reduction is a sure invitation for almost complete destruction of the river and the river basin and on account of such reduction, the saline water ingress and tidal influence will advance very significantly, i.e. even beyond Valpoi, which is almost 40 Km. upstream.

(xii)

It has been asserted by the State of Goa that fresh water flow from any river restrains the extent to which salinity intrudes into that river and with global warming, the sea levels are bound to rise and this would consequently increase the extent of salinity ingress into the river. Thus, it is maintained that in the circumstances, an increased fresh water flow would be required to restrict this emerging global phenomenon and to restrict the intrusion of saline water to its present limits. Accordingly, it is stated that the saline water boundaries would be subjected to a dual

mechanism of landward push due to reduced fresh water flow on one hand and increased sea level on the other hand, if the proposed diversion is permitted. Further, State

of Goa proceeds to state that the increased sea level would also cause increased intrusion in the ground water aquifer. It has been submitted that presently the salt water ingress and tidal influence are felt almost 36 km., from the mouth of the sea and diversion of water outside the basin by the State of Karnataka would cause the salt water to intrude further in, and thus reduce the effective catchment area and the usable yield further. Moreover, it is averred that the diversion of water outside the basin by the State of Karnataka would also reduce ground water recharge and result in increased intrusion of salt water in the aquifer.

(xiii) By way of a clarification, it is submitted that the Master Plan for Mhadei River Basin was prepared by a Panel of Experts appointed by the Government of Goa in the month of May 1999 and although the said Panel of Experts had calculated the requirement of water for different uses in the Mandovi River basin by 2050 AD, at 2674 Mcum i.e. 94.35 tmc, but it has now come to light, on the basis of further studies, that increased quantity of water would be

required for meeting the various uses in River Mandovi by that period, much above what has been calculated by the

said Panel of Experts. It has been pointed that the said Panel of Experts itself had stated that upon carrying out of detailed project investigations of the various Irrigation Schemes proposed by the State of Goa (61 Schemes), 'it would be possible to better assess the various environmental impacts and assign a scheme of priority and acceptance of these projects to be taken up considering the entire Mandovi basin from the point of environmental aspects in comparison to the compelling need of water of the various areas served by the projects'.

It is, therefore, submitted that with the advances in the environmental and hydrological sciences, the State of

Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of long term water requirement.

(xiv) It is submitted that the long-term water requirement is estimated not only for irrigation. Water is also required for

hydro-power,

drinking

purpose,

industrial

use,

control

environmental flows, inland navigation, salinity

and maintenance of appropriate river morphology. Thus, a Detailed Project Report (DPR) can be prepared only for a ‘project’ and that too involving irrigation, hydro -power and drinking-water purpose. The State pleads that DPRs cannot be prepared for the use which is not a “project” vi z. industrial use, environmental flows, inland navigation and

for

maintenance

of

appropriate

river

morphology.

term

water

Therefore, it is maintained that Goa’s long requirement cannot be determined only by what is stated in the DPR.It is further submitted that even for the irrigation, hydro-power and drinking water purposes, it is standard practice that the DPRs are prepared only upon

estimate, as available and required at the time of conceiving of a project, which when taken up for construction may vary, depending upon the requirements, and other matters such as investment and related factors. It is stated that estimation of water needs is not done by preparing DPRs and therefore estimation of water needs cannot be restricted to the quantum reflected in the DPRs. According to the State, it has already commissioned one more study for ascertaining the water requirement for

environmental flow, salinity control, inland navigation and river morphology.

The State of Goa reiterates that the proposed trans basin diversion of 24.15 tmc water from Mahadei basin for consumptive use would cause an irreparable and severe damage to it, as far as salinity ingress and tidal influences are concerned. It has been, thus, asserted that the State of Goa's require ments for water in the Mandovi River are for the human consumption – irrigation, domestic use, industrial use; and also for conservation of flora and fauna, for maintaining the appropriate river morphology for navigation, for sediment flushing, and to prevent salinity intrusion, both in the river and also in the aquifer and these environmental and morphological needs require maintaining an adequate flow in the river.

(xv) The State further describes that the second zone or sub-region, admeasuring about 541 sq.km. is a densely populated zone and there is a dense housing network, roads, public projects, Institutional and Industrial Complexes in this region. It has also been stated that there

is cultivation and agriculture in this region and any attempt at water conservation in this region, by engineering means, will result in submergence of this region/zone and consequently, prove to be counterproductive and as a matter of fact, there will be no area left even for rehabilitation purposes.

(xvi) The State has further narrated that despite difficulties, some projects, mainly to cater to the drinking water needs, had been set up at places like Sanquelim and Opa within the State. According to the State the alteration of the river/river basin profile by big States like Karnataka and Maharashtra, taking advantage of the geographical and geological position in which they are placed, would pose a very serious threat not only to the very sustenance of river/river basin, but also to the State of Goa and its peoples. It is further stated that the entire economic system, as also the ecological wealth in the form of Khazans, mangroves, agriculture, fisheries and navigation would be rendered critically vulnerable and the salinity

enhancement would completely alter the river/river basin

profile, thereby destroying the prospects of agriculture, drinking water potential, etc.

(xvii) The pleadings further go on to assert that Mahadayi River Waters sustain forest and wildlife in Wildlife Sanctuaries and National Parks in the State of Goa, like Mahadayi Wildlife Sanctuary in Sattari Taluka; Bhagwan Mahavir Wildlife Sanctuary in Mollem, Sanguem Taluka; and Bondla Wildlife Sanctuary and

waters would

any reduction in the Mahadayi

not only decimate the areas covered by Wildlife Sanctuaries and national parks admeasuring about 448.5 sq.km., but further will result in decimating the surrounding forests, particularly within the State of Karnataka, since the whole belt is one contiguous belt of forests and wilderness.

The State of Goa has submitted that the proposed diversion scheme of the State of Karnataka would cause severe and irreparable damage and loss to the forests,

wildlife and other organic life in the Mhadei basin, particularly in the upstream areas. Goa submits that in the year 1999 part of the Mhadei basin area had been declared

as Mhadei wildlife sanctuary, under the provisions of the Wildlife Protection Act 1972 and the entire area of 208 sq. km. of the Mhadei Wildlife Sanctuary falls within the Mhadei basin and is also part of the Western Ghats, which are internationally recognized as a region of immense global importance for the conservation of bio diversity. It is pleaded that the said region contains areas of high zoological cultural, and aesthetic values, and has in fact been notified as one of the bio diversity hot spots. It is averred that besides the aforesaid, the water of River Mhadei sustains the forest and wildlife in various other Wildlife Sanctuaries and National Parks in the State of Goa, namely the Bhagwan Mahavir Wildlife Sanctuary in Mollem; Bondla Wildlife Sanctuary in Ponda Taluka; and Dr. Salim Ali Bird Sanctuary in Tiswadi Taluka. It is pointed out that River Mhadei is the only river which flows through the entire territory of the Mhadei Wildlife Sanctuary as well as the Bhagwan Mahavir National Park and Wildlife Sanctuary and the Bondla Wild Life Sanctuary.

(xviii) The pleadings of Goa further maintain that the major forest types observed in the Mhadei Wildlife Sanctuary include

Southern tropical wet evergreen forest, Southern tropical semi evergreen forest and Southern tropical moist deciduous forests and this part of the Mhadei basin has varying habitat types consisting of rocky cliff, high altitude vegetation at more than 800 meters above mean sea level, river bed vegetation, riparian forests, natural grasslands, lateritic plateaus and myristica swamps. It is submitted that the presence of aforesaid habitat types in this part of the Mhadei basin is greatly influenced by the prevailing moisture level and this micro climate plays an important role in maintaining and sustaining the growth of various species of flora and fauna in the region.

(xix) It is submitted that Kalasa River enters Goa as Surla River and flows as a huge water fall identified as “Ladke Cho Vazor”. Further, it is p ointed out that besides the aforesaid, there are various other large and smaller water falls in this region which help in maintaining the moisture content in the region at the required levels, and which in turn helps in the sustenance and growth of flora and fauna in the said

region.

It is submitted that due to the present flow of water, the required moisture or mist is generated, which helps in the growth of flora and fauna in the region. It is further submitted that the luxuriant growth of ‘karivia collaosa’ on the steep rocky area in this region, and more particularly near the water falls, helps to maintain the required water level of moisture in the form of mist and, the mist from the cascades of the said water falls, meets the water demands of the vegetation in this area. According to Goa, invertebrates require moisture in completing their life cycle and this area provides ideal breeding condition for such species thereby resulting in sustenance and flourishing of biodiversity in the region. Also, this part of the Mhadei basin is a nesting site for various endangered and critically endangered pieces of flora and fauna including long billed vulture.

According to the State of Goa, this part of Mhadei basin has been identified as a bio diversity hotspot, and is inhabited by the rare, endangered and threatened species.

These species include:

Some endemic butterfly species, which are site specific and are found in the wet evergreen and semi green forest of the region.

Caecilians, frogs, fresh water species and other small endangered species. The present eco system also sustains ideal condition for breeding of various other animal species like clinotarsus, cuticeps or bicoloured frogs.

The arboreal mammals like slender loris, flying squirrels and giant squirrels.

The endangered Wroughton’s free tailed bat and Theobald’s tomb bat, which is on the rare species list. It is submitted that Barapedi caves in the Mhadei valley is the only place where Wroughton’s free tailed bat is found in the whole world.

(xx) The pleadings further state that river in its upper reaches plays an important role in adding nutrients into the food chain with its eroding action, the nutrients, which are trapped in river bank are dissolved in oxygenated water. It is submitted that if the proposed diversion scheme of

Karnataka is given effect to, it would result in changing the hydraulic characteristics of Mhadei River, reduction in flow of water in the river thereby disturbing the delicate balance required for sustenance and growth of habitat in the region. According to State of Goa, the water flow/moisture content presently available in the said region will be considerably reduced, varied or changed, and this would, severely and irreparably, affect the flora and fauna in the region. It is mentioned that certain species of fauna such as lepidopterans or butterflies are highly sensitive faunal components in the eco system and can react to the slightest variation in the climatic condition in the locality, whereas decrease in the moisture level in this area would also affect the survival of Malabar tree toads and Malabar gliding frogs thereby leading to local extinction of the species. It is mentioned that the arboreal mammals like slender loris, flying squirrels and giant squirrels play important role in the maintenance and disbursal of forest and any variation in the vegetation or insect fauna of this area would push such

animals on the verge of local extinction.

(xxi) The State of Goa has asserted that the proposed diversion scheme of the State of Karnataka is in gross violation of the provisions of Section 29 of the Wildlife (Protection) Act, 1972 in as much as the same would severely result in destruction, exploitation, damage, diversion of habitat from the wildlife sanctuary and also diversion or stoppage of flow of water into and/or outside the wildlife sanctuary. The State of Goa further reiterates all its other objections as far as the proposed diversion scheme of State of Karnataka is concerned, by asserting that the State of Karnataka has not obtained at all the required clearances/ permissions under the various Environmental and Forest Legislations.

(xxii) The Goa State has pleaded that it has a geographical area of 3702 sq.km. Mandovi river basin in Goa occupies an area of 42.70% of the total Goa State's geographical area and this region abounds with six Talukas, comprising about 194 villages and has cultivable land to the extent of 91072 Ha., and flora, fauna and vegetation of 77975 Ha. It is averred that as per the 1991 Census, the population in the basin

area was about 507468, which has significantly risen over the years and the most important towns in the State of Goa

lie within the basin or are on the Banks of River Mandovi. According to State of Goa the entire region is heavily dependent upon River Mandovi for drinking water needs in particular; the towns of Valpoi, Bicholim, Mapusa, Panaji and Ponda are dependent upon Mandovi/ Mahadayi river basin and the fresh waters therein for the purpose of drinking water and the Mandovi/Mahadayi river is the virtual lifeline for the entire State of Goa.

(xxiii) It is maintained that in contrast, hardly 375 sq.km. of the river basin area falls within the State of Karnataka and 77 sq.km., within the State of Maharashtra and these areas correspond to 0.20% and 0.025%, respectively, of the total State areas of those respective States. As set out earlier, according to State of Goa Mandovi river basin covers 42.70% of the total State area of the Goa State, whereas the further total length of the Mandovi River from the source to the Arabian Sea is about 87 Km. and the initial 35 Km., or thereabouts is in Karnataka and the remaining 52 Km., is in the State of Goa. The State of Goa has asserted that, it is

almost entirely dependent upon this river and its basin for its drinking water needs, navigation, tourism, fishing, etc. It

is explained that the wellbeing, sustenance and even the basic existence of the inhabitants in the State of Goa is dependent upon this river and the river basin, but account of the fortuitous circumstance that the State of Goa is the lowermost riparian State and the States of Karnataka and Maharashtra are the uppermost riparian States, these States should not be permitted to virtually destroy and ruin the State of Goa and its inhabitants by undertaking measures which will prevent or in any case significantly reduce the fresh water flows into this river and basin.

(xxiv) It is pleaded that the Mahadayi river/river basin, is already a water deficit basin as per the Master Plan prepared by the Panel of Experts, the projected water requirement by 2051 A.D. would be 2674 Mcum., and the water resources actually available in the river/river basin would be in the range of 1532 Mcum.

Further, it is asserted that apart from the issue of deficit, any attempts for alteration of river profile in the

uppermost reaches within the States of Karnataka and Maharashtra is bound to endanger the very sustenance of the river and its basin within the State of Goa. As stated

earlier, this river basin corresponds to 42.70% of the total of Goa State Area and in contrast, the river basin/drainage area within the States of Karnataka and Maharashtra corresponds to 0.2% and 0.025% of their respective total State Areas. From this, it is pleaded that it is apparent that the sustenance of the river and the river basin is virtually a sine qua non to the sustenance and survival of the very State of Goa and its people.

(xxv) Pleadings of the State further assert that the State of Goa has about 555 Km., of inland water ways, out of which about 255 Km., are navigable through rivers Mhadei and Zuari, including through the Cumbarjua canal and their respective tributaries. The State of Goa further states that out of their total length, the better part of these navigational channels is being used by the Mining and Export industry for transportation of iron ore to the Port of Marmugao from the loading points in the hinterlands. The State of Goa states that these internal waterways are natural waterways, which provide quick and navigational

transportation facilities in the State of Goa for passengers,

as well as cargo traffic and these channels are in existence

since times immemorial. It is mentioned that, it is pertinent to note that the Shipping Industry in Goa plays a pivotal role in the economic growth of not only the State, but also the Nation and additionally, tourism development activities are also taking place in these water ways throughout the State of Goa. The State of Goa further submits that there are various ferry routes in the State of Goa, such as Panaji to Betim, Ribandar to Chorao, Ribandar to Divar, Old Goa to Divar, Gaundale to Kumbarjua, Sarmonas to Marcel, Amona to Mayem, Narvem to Divar, Aldona to Kalvim, Aldona to Khorjuem etc., and all the aforesaid are on river Mhadei, and in addition to the aforesaid ferry boats, meant for passenger and vehicle transportation, there is continuous movement of barges, movement of launches, trawlers, other tourist boats, yachts, being an important tourist destination, as also, huge boats entering Panaji port, which require sufficient draft in the river, failing which the entire movement on the river, on which the economy of the State is heavily dependent, as also for the commutation of

general public, will be severely affected. It is stated that the same cater to transportation of general public from one point to another, including some places where the only

option of travel to the main land is through a ferry route and,

therefore, it can be emphatically stated that the inland water ways of Goa are a life line, to not just to the general public at large, but also to the financial, tourism and economic growth of the State of Goa. It is submitted that even a trifling damage to the inland water ways in the State of Goa will cause massive and disastrous results, affecting at a very large scale, the economic and financial growth of the State, in addition to causing hardships to the general public at large, and extensive damage to the very sensitive environment.

(xxvi) The State maintains that the activity of any kind of abstraction, including any kind of trans-basin or inter-basin diversion of Mahadayi river, by the States of Karnataka and Maharashtra is a matter of aggravating concern for the State of Goa and in the event the flow of Mahadayi River is restricted, or in any manner affected by the States of Maharashtra and Karnataka, the same shall have wide

spread and absolutely negative impacts in the State of Goa.

Furthermore, it is mentioned that the present available depth within the navigational passage in the Mhadei River is 3.00 mts. over all and the movement of the vessels having the draught of 3.3 mts., is regulated to ply during the high-water period only, but in the event the flow of Mahadayi river is depleted to the slightest extent, the same will result in immediate reduction of the depth of the Mhadei river in the State of Goa, thereby affecting the movement of all the vessels, cargo, barges, launches as well as passengers even during the high-water period.

It is pointed out that the reduction of flow will also have a direct impact on the loading capacity of the barges, which are used by the mining industry for transportation of iron ore. The State of Goa states that the revenues directly earned by the State through the shipping and barge industry will be immediately affected, causing downturn in the revenue coffers of the State, as well as loss of precious foreign exchange to the country, thereby affecting the national economy. Furthermore, what is mentioned is that

the domino effect will also be felt by the people dependent on the shipping and barge industry, thereby causing

hardships to the people at large. The State of Goa states that the Shipping and Barge Industry, including people directly and indirectly dependent on the same, are already yet to recover from the major financial loss, caused due to the Mining Ban for almost 3 years, which was imposed in the State of Goa. The State of Goa states that upon lifting of the ban, the people dependent on Shipping and Barge Industry are looking forward to make good the economic downturn.

According to the State any attempt by the States of Karnataka and Maharashtra in diverting the waters of River Mahadayi will result in depletion of flow in the River, thereby directly affecting the Shipping and Barge Industry and ferry and boat services, causing further irrecoverable damage to the Industry. It is emphasized that mining exports earn valuable foreign exchange for the national economy.

(xxvii) It is maintained that the reduction in flow of Mahadayi river to the slightest levels will also raise safety concerns in as

much as there are maximum chances of having casualties of the barges since the Masters of the vessels will be totally misguided in the navigational approach thereby grounding

or stranding of the vessels. It is averred that at any rate, there will be a devastating effect across the ferry services in the inland water ways thereby causing panicky situation amongst general public and commuters.

(xxviii) According to the pleadings the tourism activity in Goa has been booming since the late 1960's, and the State of Goa is regarded as one of the most preferred and best tourist destinations in the world. It is pleaded that in furtherance of keeping up with the progress in the tourism industry, the State of Goa has continuously endeavored to provide tourism related activities in the inner remote parts of the State, which are mostly connected through the inland water ways. The State of Goa has submitted that, as a result of such promoting of tourism related activities, the tourism potential in the interior parts of the State has been booming and the immediate effect of such booming would result in large scale tourism related activities being carried out on these inland water ways. The State of Goa further states that a large number of tourists visit such areas,

thereby generating large amount of revenue for the State coffers, as well as providing valuable employment and

entrepreneurship to the local residents of the State of Goa and as these inland water ways form the backbone of such tourism related activity, any reduction in the flow of the Mhadei River will have large scale impact on the tourism related activities including to the extent of wiping out this industry, which has been set up by the State of Goa through manifest efforts.

(xxix) It is maintained that Panaji port is a seasonal port, which generally operates from mid-September to mid-May and the movement of barges and other water borne vessels is maintained in between Mhadei 0 river and Zuari river through the Cumbarjua canal. The State of Goa submits that this is possible as there is a proper flow of run-off coming from the Mhadei River, coupled with the incursion of tidal waters from the sea, resultantly causing the depth of the water to be just about sufficient for safe navigation through the Cumbarjua canal. It is, therefore, maintained that in the event the flow of Mhadei River is depleted to the slightest extent, the same will result in reduction of depth of the

river and/or canal, thereby adversely affecting the movement of vessels even during the high-water period.

(xxx) According to the State of Goa there is already existing a massive problem of sedimentation in Mhadei River, due to the presence of silty clay, sandy silt, and beach sediments on the sea bed and the river bed, which is usually taken care by the flow of Mhadei River which flush out the sediments, in addition to the dredging carried out by the State of Goa. It is mentioned that in the event the flow of Mhadei River is depleted, the same will cause enhanced sand deposition at the mouth of Mhadei River, which would significantly affect the safe navigation during the fair-weather season. The State of Goa submits that even regular maintenance dredging will not suffice to ensure safe navigation, and any advanced levels of maintenance dragging used will be at very high cost making the entire operation economically unviable and furthermore, also cause damage to the fragile eco-system in the River.
The State of Goa, therefore, submits that the inland water ways of Goa are a life line of Goa and any attempt whatsoever to reduce the flow of Mhadei river, even to a

minuscule extent, will cause the navigational traffic in inland water ways of Goa, to be completely disrupted and

such disruption will have disastrous effects on the economy of the State and Nation as well as the local residents.

(xxxi) It is maintained that the mining and export of mineral ore and tourism are the backbone of Goan economy and also make substantial contribution to the national GDP. It is explained that the Marmugao Port serves as an outlet for export of iron ore and the iron ore stocks are brought to the Marmugao Port through barges, which ply on the Mandovi and Zuari rivers. It is explained that the Marmugao Port, which is situated in Zuari basin, is connected to the Mhadei basin (Mandovi River) through a natural channel known as 'Cumbarjua Channel'. It is submitted that the Aguada bay of Mhadei River and the Cortalim bay of Zuari River culminates into and forms Marmugao bay, where the Marmugao Harbour is situated. It is further submitted that the navigational channel through the last stretch of River Mandovi extends into the sea and ends with the Port, which is located on the banks of River Zuari and there are 30 river loading jetties along the Mandovi River.

It is submitted that as at present, around 600 barges transit through this channel. Cumbarjua Channel is a natural channel having a length of about 17 km., and an existing draft (water depth) of approx. 2.60 mts., or more. It is submitted that smooth and safe passage of barges through the Cumbarjua Channel is possible as at present, since a draft (water depth) of 2.60 mts., or thereabouts, is available, but, the proposed diversion of water of river Mhadei will affect the existing draft of the river/Cumbarjua channel, and hamper smooth and safe navigation in the region.

(xxxii) According to the State of Goa, it is an acknowledged fact that every navigational channel runs the risk of sediment deposition in its channel, and the sediments entering the channel need to be flushed out by force of flowing water. Goa maintains that such sediments may enter the river not only from the upstream catchment but also from the sea side and flushing of sediments requires not only a particular depth of water but also certain amount of velocity or water

flow. Thus, it is submitted that even in the present situation, there is a severe problem of sediment deposition

noticed between Diwar and Chorao islands and, therefore, any further reduction in the flow of river Mandovi due to the proposed diversion scheme of the State of Karnataka will only aggravate such sediment deposition, due to reduction in velocity/water flow in the Mandovi River and Cumbarjua Channel.

According to Goa, the flow of water from Mandovi through the Cumbarjua channel and then to Zuari and Marmugao Port helps flushing of sediments in the navigational reach, comprising of Cumbarjua, Zuari and Marmugao Port and, therefore, it is asserted that the Cumbarjua channel is not a natural interconnection between the two rivers, and water from Mandovi River flows down to Zuari River through the Cumbarjua channel.

(xxxiii) The State of Goa reiterates that the diversion of water from River Mhadei, which is proposed by the State of Karnataka would reduce the existing draft (water depth) critically and thereby affect the inland navigation, movement of iron or

laden barges and other tourism related cruise liners in the

Mandovi River and more particularly in the Cumbarjua Channel.

(xxxiv) Goa continues to state that there are number of tributaries and sub-tributaries joining the river Mahadayi in all the three States. According to State of Goa, principal tributaries, State-wise, pertinent to the dispute, are:

A)

In Karnataka ;

i) Bail Nadi; ii) Irti Nadi; iii) Katni Nadi; iv) Murudhuhaul Nalla; v) Pansher Nallah; vi) Andher Nallah, discharging directly in the main river; and vii) Haltar Nallah, flowing in Western direction in Maharashtra and joining down stream with Kattika Nallah, originating in that State.

B)

In Goa :i) Nanode or Surla Nadi; ii) Kotrachi or Veluz Nadi; iii) Kudne Nadi; iv) Valvanti Nadi; v) Bicholim Nadi; vi) Mapusa Nadi; vii) Ragada or Gangem Nadi;

viii) Dudhsagar or Khandepar Nadhi and ix) Sinkerim Nadi, discharging directly in the main river;

C)

In Maharashtra :i) Haltara Nallah, originating in Karnataka, which flows in Maharashtra and is known as Virdi Nadi, and then in Goa, where it is known as Valvanti river; and ii) Kattika Nallah, meeting the main Virdi river near Virdi village in Maharashtra, and from their confluence flowing in South direction and joining Costi Nallah in Goa at Gontelli, forming Valvanti Nadi. In addition, there are small nallahs originating in Maharashtra joining Bicholim and Baga rivers which are tributaries of Mandovi River.

(xxxv) Giving the details of catchment area of river Mahadayi, the State of Goa has detailed that the core catchment area of the Mahadayi lies in the heavy rainfall (3800mm-5700mm per annum) thickly forested, approximately 200 sq.km., of mountain topography of Khanapur taluka, barely 10 km. upstream of Valpoi in Goa. It is stated that a very large quantity of water that flows down the Mandovi, all the year round, originates in the streams and rivulets around

Kanakumbi, Jamboti, Talewadi, Gavali and Hemadga villages, where Karnatak a’s diversion and hydroelectric dams are to come up. It is explained that the Mandovi

River, Goa's lifeline, faces imminent threat of choking because of the reduction in water flow, siltation and disruption of its ecology, due to change in its profile - perhaps being even reduced to a trickle in the summer months. It is asserted that every variation in the Mahadayi water level will be crucial for Goa's ecology, forests, wildlife, agriculture, drinking water, fishing and transportation.

It is averred that the Mahadayi rises on the eastern slopes of the Sahyadri's crestline near Degaon village and the origin of the Mahadayi is a multitude of streams from within the fan shaped surrounding hills, capped by dense, pristine forests. It is stated that Bavali village also claims the origin of the river Mahadayi and the temple and tank near it

at Gavli Village, is said to be the source of the Mahadayi. It is mentioned that it flows eastward for a short distance and then loops into an arc around the ridges and turns westward across the crestline into Goa where both, the Malaprabha and the Mahadayi run parallel to each other for some distance but flow in the opposite directions.

(xxxvi) Giving further details, it is stated that between the Malaprabha river at Kanakumbi in the north, Khanapur to the east, Anmod Ghat on the Goa highway to the south and Mollem/Madei wildlife sanctuaries across the crestline in Goa to the west, the Mahadayi valley with its luxurious forest covers an area of approximately 750 sq.km. It is stated that the valley is studded with graceful peaks, deep gorges, thick pristine monsoon forests and flat terraces of paddy fields at the bottom.

It is explained that as many as 75 big and small streams join the Mahadayi at various stages increasing its volume and velocity and the main tributaries of the Mahadayi in the upper and middle catchment areas in Karnataka are small streams of an average length of 5 to 10 km., and as one follows the flow, they are: Right Bank: Bhandura Nala near Kongla, Singar Nala, Doli Nala, Kotni Nala, Irti Nala, Bail Nadi. Left Bank: Pansheer Nala, Madhuhalla Nala. It is explained that these two streams arise on the crest line astride Talewadi and rush down on

either side of the Barapedi caves within a km of each other near Krishnapur in the lower loop.

It is stated that north of the loop near Kanakumbi in the catchment area of Malaprabha River, two potent streams - Kalasa and Surla (Bhandura Nala) join east of Chorla and flow across the crestline as Surla river in Goa emptying into the Madei above Valpoi at Nanode in Goa. It is explained that these two streams are very important and major streams that feed the Mahadayi river.

It is mentioned that the valley is a scenic treat and one of the richest reservoirs of biodiversity in the world and reflects the complexity in plant, animal and bird life and is home to endangered bat species. It is stated that the valley is comparable to the Silent valley of Kerala in its significance and an important biological and ecological remaining pocket in the Western Ghats where about thirty villages scattered over the area remain poor, ill-served and rejected in the midst of thick resource-rich forests.

According to State of Goa the ruins of Bhimgad, an old Maratha fort is located north-east of Mollem Wildlife Sanctuary in Goa and north of Dandeli Wildlife Sanctuary in

Uttara Kannada District of Karnataka and the area forms a core part of the Western Ghats.

It is explained that vertical rock cave amphitheaters of Krishnapur near Goa border are gigantic wall formations 1000-1500ft in height, and the caves are extremely difficult to access, and have remained untouched and are nature's secret providing haven to a large number of floral and faunal species. It is stated that the steep drop of over 300 meters near Krishnapur and over 400 meters near Bhimgad to the valley down below is breathtaking and thereafter, the land rises to the north of the Mahadayi to peaks of about 700 meters at Kedi Paunda and Tamadi Mokh whereas 12 km., from Jamboti is Vajra Poha waterfalls and here the river Mahadayi is joined by two other streams - Maradha Nala and Pansheer Nala, creating the magnificent Vajra Poha waterfalls. It is stated that the Mahadayi takes a leap of over 150 ft. with rapids above and below the waterfalls and the village of Nersa in Khanapur nestles in the thick forests of Mahadayi valley. It is mentioned that

one of the proposed dams is to be built close to this village

on Bhandura/Singar Nala confluence, submerging a sizeable area and threatening the very existence of this village.

(xxxvii) It is further stated that the Mahadayi River enters Goa near Khanapur taluka border, below Sosodurg (called Dara Singha peak on Karnataka side), the highest peak in the Sahyadris (1019 m.) in Goa. It is informed that in the upper reaches of the river in Sattari valley the river is called Madei and it flows for about 20 km., westward till it reaches Bembol, the point of its confluence with Khandepar river from where the river is called the Mandovi till it meets the Arabian sea ahead of Panaji.

(xxxviii) The pleadings continue to state that Sattari taluka is crisscrossed with innumerable streams flowing from the Western Ghats, from the Maharashtra state in the north and Karnataka in the west and prominent among them are four streams: Surla (or Nandode Nadi), Valvanti, Kotrachi Nadi and Ragada.

Surla River (Nanode Nadi): Surla river originates in the

dense forests of Surla and Kanakumbi in the Western Ghats of Karnataka. Kalasa Nala joins it before it enters

Goa. Two main streams join Surla River in Sattari - Mundrichi Nadi and Deuchi Nadi.

Surla River joins Madei near the village of Nanode above Valpoi. The length of this stream in Sattari is about 20 km.

Valvanti River: The Valvanti (Haltar/Virdi nallah/river) rises in the Western Ghats and enters Goa at Shiroli and it flows south for 21.5 km., and joins the Mandovi at Sarmanas. The river is subject to tidal influence up to Sanquelim. River Valvanti has three main tributaries: Costi Nadi (8.5 km.) joins the Valvanti at Ghoteli in Sattari. Cudne Nadi (17 km.) joins the Valvanti at Karkhajan. Dicholi (15 km.): originates in the Western Ghats of Maharashtra and enters Goa at Kudchirem to join the Valvanti at Karapur.

Kotrachi Nadi: This stream emerges from the dense

forests of Golali and Ivrem-Budruck. It flows southward and joins Madei at Velguem in Sattari.



Ragada River: Originates in the Western Ghats and flows north-west over a distance of 35 kms and joins the Madei at Guleli. The Ragada itself has a tributary - Jamboli which starts at the Karnataka border runs

westward till Jamboli and then north-west to join the Ragada.

The other important streams that join the Madei in Sattari are: Kumbhtol (10.5 km.), Patwal (10 km.), Zarme (11.5 km.), Khotodem (9.5 km.) and Advoi (8 km.).

(xxxix)

The pleadings continue to state that in Goa, after a restricted course through the flat-topped range, while receiving waters of the Valvanti coming from Ambekhol of Chorla Ghat, and as many other smaller streams join in, the Madei emerges into a more open valley and from Bembol to Pilgao takes a north westerly course for about 17 km., swinging towards the west to join the Arabian sea at Panaji and from Bembol, where it meets the river Khandepar, the Madei becomes the Mandovi.

It is mentioned that as the tributaries join in, in its estuarial region, it develops a broad and slow-moving

course accompanied by remarkable changes in the landscape and drainage, characterised by the typical features of a drowned topography with the island of Divar

standing prominently in mid-course, with its northern counterpart, the island of Chorao, not looking so prominent as an island, because it is on the right bank of the Mandovi, encircled by the small but complex network of Mapusa river drainage. It is stated that Khandepar River in the south and Mapusa river network of drainage in the north are the important tributaries of Mandovi in Goa. It is informed that the Khandepar river originates in the Western Ghats on Karnataka side and enters Goa through the Castlerock heights, and plunges down as the beautiful Dudhsagar waterfalls.

According to the pleadings, it is also called the Dudhsagar river in this stretch, and after the falls, it runs in a deep valley for some distance, till the village of Colem turning north to Colem Nala, a tributary which originates on the Karnataka boundary in the Western Ghats and runs westward till Pimpalquin and then turns north, till it joins the Dudhsagar (Khandepar) river, with a total length of 29 km. It is stated that Khandepar river valley is broad with

alluvial embankments, and is dominated by plateau heights occasionally showing peaks and has a large drainage area

through its tributaries in the South, draining the area of north Sanguem and Ponda talukas in its wake.

It is mentioned that Mapusa River originates in the dense forests of Dumacem and Amthane and flows southward for 26 km., and joins the Mandovi at Penha de Franca whereas the Moide, a tributary of river Mapusa originates in Guirim flows northeast for 17 km., and joins the Mapusa River at Sircaim. What is stated is that the Mapusa river drainage consists of threaded and ill-defined streams in broad, flat and in some places marshy levels skirted by the Nandoli-Porvorim-Mapusa-Assonora-Sirigao plateau heights and shows that the whole low-level tract is infilled alluvium, fed by waters as well as debris by the steep down cutting rivulets of the plateau rims, of which the Assonora stream is the longest. It is asserted that the river starts from Alto-Porvorim hillock in Bardez and flows westward through Pilerne, Verem, Nerul, Candolim and joins the Mandovi at Sinquerim and the river length is 11 km. The church at the confluence of the Mapusa river and

the Mandovi river stands very prominently on the river bank of the Mandovi.

(xl)

According to pleadings, the Mandovi is the widest, approximately 4 km. at the Bay of Aguada and river Sinquerim joins it in this bay, whereas the Mapusa river joins the Mandovi at the upstream end of a 6 km., stretch, and Divar island, approximately 11 km., long, bifurcates the Mandovi into two channels. It is mentioned that before joining at the upstream end of the island, the two channels lead into an extensive network of narrow channels in a marshy area and the Cumbarjua canal joins the Mandovi about 4 km upstream of the Divar island. It is averred that the 30 km stretch of the main channel of the Mandovi, from the eastern edge of the Divar Island to Ganjem, gets progressively narrower and shallower in the upstream direction and rivers Dicholi, Volvonta, Kudnem and Khandepar join the Mandovi along this stretch, Khandepar being the largest of the four streams which is fed by the river Dudhsagar at its upstream end.

It is maintained that the core catchment area of the

Mahadayi lies in the heavy rainfall, thickly forested, approximately 200 sq.km., of mountain topography of Khanapur taluka, barely 10 km., upstream of Valpoi in Goa,

where Karnataka's diversion and hydroelectric dams are to come up and the biggest ecological damage inflicted upon the Western Ghats is deforestation. It is claimed that the Western Ghats eco-region with an area of about 1,59,000 sq.km., has been classified as a global 'Hotspot', which means that this is an area which is rich in endemic plant species and which has already lost more than 70% of its original habitat and is under severe threat due to human pressure.

(xli)

The State of Goa has expressed its apprehensions by stating that with water diversion and hydroelectric projects, the Mandovi river, Goa's life -line, faces imminent threat of choking because of the reduction in water flow, siltation and disruption of its ecology due to change in its profile - perhaps being even reduced to a trickle in the summer months, and possibility of seismic disturbances.

It is further stated that the main threat that is now looming over the valley is the Karnataka Government's

plans to divert a large quantum of water from the Mahadayi River and its tributaries to the Malaprabha river basin, to

help the alleged water shortages in the Malaprabha basin, but as long as the exploitation of water resources continues in the Malaprabha region, no matter how much water, and from where it is diverted, the Malaprabha valley is likely to face the same situation in the near future. It is stated that the project is far more ambitious and it includes building as many as 11 dams on the Mahadayi and its tributaries in this small area along with hydroelectric projects. What is averred is that the project appears to aim at impounding a large portion of waters from the Mahadayi and its tributaries that flows into Goa, which will mean that Karnataka retains and controls all the dams and the Mahadayi waters, an exercise which will be impermissible under the Constitution in a federal structure like ours. Pleadings maintain that it is estimated that this project will submerge a vast area amounting to about 3,000 Ha; most of it will be the thick forested area on Karnataka side of the valley and once these forests are destroyed there will be a drastic change in the ecology of the valley

reducing the rainfall, ruining its forests, wildlife, and all its natural wealth.

(xlii)

It is indicated that quite a number of ancient stone sculptures, representing the River Goddess have been discovered in and around the banks of the Mahadayi River, both in Khanapur, Karnataka, and in Goa indicating the existence of a dominating cult of the River Goddess in the area and the Boat Goddess sculptures depict the Goddess standing in a boat, holding a dagger in her right hand and a bowl in her left hand and is known by various names such as ‘Naukayana’ Devi (Boat Goddess), ‘Ashtabhuja’ (eight hands) Durga, ‘Mahishasuramardini’, etc.,and all these sculptures probably belong to Kadamba period (12th or 13th century AD). These sculptures have been found mostly in Sattari taluka at Nadve, Savarde, Dhamashe, Shel-Melawalli, Dhada and Guleli.

It is stated that Mahadayi River originates in Khanapur taluka of Karnataka, but for the people of Khanapur and the eastern taluka of Sattari in Goa, SHE is the MAHADAYI – “the Great Mother Goddess” as the name itself implies.

Whereas the number of ancient carved images found scattered at Amagaon and Parvada in Khanapur Taluka and Sattari taluka of Goa at Caranzol, Savarde, Kodal, Rivem, Irvem, etc. represent the cult of the Mother Goddess

worship on the banks of the Madei. It is informed that the river Mahadayi becomes Madei in Sattari taluka of Goa and after the river Khandepar joins it at Bembol the river is called the Mandovi and like most monsoon-fed rivers, the Mahadayi also undergoes bewildering transformation during her seasons; slack, limpid pools of winter, partially dry beds of summer turning to fearsome torrents during the monsoons, submerging everything in its way and awesome in her destructive potential.

(xliii)

In the pleadings Goa makes a grievance that Karnataka's unilateral decision to go ahead with the Mahadayi River Valley projects is now amounting to a very real threat and Karnataka is fully aware that the Mahadayi/Mandovi is a lifeline river for Goa and yet it is hell bent on diverting the Mahadayi waters into the Malaprabha basin. It is mentioned that most of the water from Karnataka's Naviluteertha reservoir on Malaprabha goes for irrigation of water guzzling crops like sugarcane in its upper reaches.

Goa states that assuming, without in any manner admitting, that there is any Water Scarcity in Hubli-Dharwad region, then the same is due to the deliberate usage of water from

the Malaprabha Basin (Which was earmarked for drinking water purpose) for the purpose of irrigating the cash crops in the Hubli-Dharwad region.

It is stated that Goa has been at the mercy of its two larger and powerful neighbours and bordering states of Maharashtra to the north and Karnataka to the east and the south whereas most of Goa's major streams - Tiracol, Chapora, Mandovi, Surla, Ragada, Khandepar and Galgibag originate just across the border in the Western Ghats of either Maharashtra or Karnataka. According to State of Goa, for this reason, Goa is an extremely vulnerable state when its bigger neighbours draw ambitious plans to create large storages or divert waters close to the sources of rivers flowing into Goa. It is stated that the Mahadayi River Valley is one of the few remaining areas of wilderness in the Sahyadris and like the threats to these remaining wildernesses all over the world, this piece of wilderness is also facing several threats due to human pressure.

(xliv)

According to the State of Goa, the Kalasa-Bhandura water diversion scheme, on which the work had already been

commenced, is going to submerge about 723 Ha (Kalasa 320 Ha & Bhandura 403 Ha).

It has been stated that if Karnataka were to go ahead with the Kotni Hydroelectric & diversion project on the scale, that it has been planned, the total area to be submerged will be 2145 Ha forests plus another 330 Ha of forest land for roads, dams power houses, township, field offices, etc., and the villages that will be submerged, some of them completely, and some partially are: Kanakumbi, Parwad, Chorla, Kongla, Kirwale and Kabnail, Gavali, Pastoli, Nerse, Jamgaon, Mugwede, Chapoli, Jamgaon and Kavale.

It has been pointed out that the forest cover of Belgaum district would be reduced from 13% to 8%, after releasing the forest land to Mahadayi Diversion and Hydro-electric project and reduction in forest cover would have considerable effect on the climate - reduction in rainfall, temperature and humidity contributing to global warming. (xlv)

According to Goa what the Mahadayi project is set to do is to destroy permanently an area, rich in biodiversity, which ranks second in India after Sundarbans and eighth in the

world as the finest Tiger habitat, and is home to many species of flora and fauna, including endangered Wroughton's Free - tailed bat and Theobald's Tomb bat. It is maintained that Barapedi caves in the Mahadayi valley is the only place where Wroughton's Free -tailed bat is found in the whole world, and Theobal d's Tomb bat is rare. It is stated that apart from Krishnapur caves it survives only in two other places in India.

(xlvi)

In the pleadings of Goa, it is stated that the construction work on the Kalasa-Bhandura diversion dam for which the foundation stone was laid on September 22, 2006 at Kanakumbi, near Goa-Karnataka border, is progressing

rapidly, and the project is threatening to wipe out this millennial old culture and society. It is maintained that Goa, although a small State, is one of the most prosperous States of the Indian Union, paying the highest per capita tax, and earns the highest per capita foreign exchange and mining, tourism, corporate taxes, income tax, excise etc. net about Rs. 8,000 crores per annum to the National Exchequer.

It is fu rther stated that the change in the Mondovi's profile will also adversely alter the ecology of its estuarine, thickly populated islands of Chorao, Diwar, Corjuem, Jua, Cumbharjua, etc., whereas the state of Karnataka does not have any Environmental Clearance and the project is being carried out in violation of the Forest (Conservation) Act, 1980 and all other laws.

(xlvii)

According to the pleadings of Goa the fresh water flow from the Mahadayi River in Khanapur taluka maintains the Mandovi and the Mandovi is a tidal estuary which means that it is an extended arm of the sea with tidal salt water intrusion but the fresh water flow keeps the salinity at a certain level and reduction in the fresh water flow will disturb the fresh water regime by pushing up the salinity to a much higher level.

It is maintained that the diversion of water by States of Karnataka and Maharashtra would have a devastating effect on the agriculture of Mhadei River Basin. It is stated

that the Madei/Mhadei/Mhadei River is a perennial source of sweet water which runs about 76 km., within the state of

Goa, of which around 46 km., that is up to Ganjem is saline water, which leaves only 30 km., of fresh water within the state of Goa, spanning now seven (earlier six) potential Agriculture Talukas of the State of Goa in the Mhadei basin. It is averred that it runs across Sattari, Sanguem, Dharbandora (newly created), Ponda, Bicholim, Bardez and Tiswadi before meeting the Arabian Sea.

Further, it is stated that Mhadei River Basin comprises hilly terrain, agricultural land, alluvial plains, Ker lands, Morod land, Khazan land forms, wildlife sanctuary areas, forest areas, huge collection of Mangroves, flora and fauna, Western Ghats and many streams and tributaries further extend the coverage and utility of River Mhadei.

(xlviii)

It is pleaded that Mhadei River Basin being a fertile Agriculture land with assured source of irrigation, many people have settled in this area from ages and taken up

agriculture as their sole profession and only source of livelihood.

What is maintained is to enhance the utility of the available irrigation water, the ancestors had developed various innovative ideas like construction of bunds and Vassant bandaras, across the rivers to facilitate irrigation for Rabi and summer crops and they have also constructed sluice gates to control the intrusion of saline water. It is put forward that on the either sides of the river, the farmers have resorted to ‘Puran Sheti’ on the fertile alluvial soils in Sattari Taluka.

It is maintained that agriculture is an important economic activity for the farmers of this region. They are totally dependent on Agriculture as their main source of livelihood and the farmers have taken up subsidiary occupations like Dairy, Goatery, Rabbit Farming to supplement their income. It is stated that with the advent of new innovations in this Sector, the farmers have adapted to the new development in Agriculture.

(xlix)

Goa maintains that River Mhadei is adored by the sons of

this region as their mother and she nurtures them, and she is a witness to their progress since ages. According to State

of Goa, she is the cause of their pathway to the development and success and for all the reasons, she is 'Goddess' like the divine river Ganga.

It is further emphasized that what is referred to as "Jeevan" or "Amruta" in Hindu mythology is River Mhadei, which is rightly called the lifeline of the inhabitants. According to the State of Goa any attempt, or proposed projects, which will have any consequence of either reduction or otherwise effecting the flow of water in Mhadei river, consequently, leading to reduction in its depth will have a drastic and permanent impact on the Agriculture Sector of this State. It is asserted that this effect will be unquantifiable, irreversible and would amount to negating the development done since ages and it can have a heavy toll on socio-economic front of the inhabitants and the State at large.

(l)

As per the pleadings of Goa, the farmers in Mhadei River Basin area are hardworking and of innovative nature and

they quickly adopt to modern agricultural practices. It is

informed that they have taken up many initiatives, owing to their working abilities and agriculture extension work by the State Agriculture Department of Government of Goa and they have taken up many agricultural development schemes of Government, anticipating good returns for them and their offsprings for years to come.

It is stated that agriculture is admittedly a premier national agro-industry of the country and the State of Goa has laid special emphasis on the Agriculture Sector. It is mentioned that indeed, the other two sectors of the economy, namely tertiary and secondary, are virtually interlinked and inter dependent on this sector and if the agricultural production is affected, it will create disastrous consequences, as a result of which taking any steps which in the process will consequently affect the Agricultural Sector, and the farmers in question, who are all dependent on the fresh water of Mhadei River for their agricultural plantations, will mean a complete negation of Article 14, as well as Article 19(1)(g) and Article 21 of the constitution of

India. It is asserted that this will also hit the Directives Principles of State Policy, which are enshrined in part 4 of

the Constitution of India, envisaging a special emphasis on the agricultural sector as a means of production on the economy.

The state of Goa pleads that high handed and abrasive actions on the part of State of Karnataka and State of Maharashtra are and will directly affect the Fundamental Rights of the people of Goa, and more particularly the citizens inhabiting in the Mhadei Basin and such high handed unilateral actions of the State of Karnataka, diverting water, destruction of ecology, destroying agricultural activities, and endangering the livelihood of the citizens in the Mhadei river basin, is in complete breach of Article 14, Article 19(1) (g) and Article 21 of the Constitution of India.

The State of Goa has submitted that the state of Karnataka has acted most arbitrarily, high handedly unreasonably and in a most obnoxious manner and such conduct on the part of State of Karnataka is most depreciable because the State of Karnataka has directly infringed the Fundamental Rights of the citizens in the Mhadei basin. It is stated that the actions and attempts on

the part of state of Karnataka would result in taking away livelihood as also right of ecology and environment which is a facet of Article 21 of the Constitution of India. According to State of Goa the actions of Karnataka smack of a complete over-enthusiasm on their part, which by now is well known to be an abated enthusiasm for garnishing the sugar lobby in the State of Karnataka, and to augment the sugar production, that too at the cost of, and by violating the rights, privileges, and the rightful entitlements of the people living in the riparian States, which is an exercise impermissible in law.

The State of Goa states that the agricultural activities of cashew plantation, paddy, nachni, cash crops, mango plantation are the main crops for the farmers in the Mhadei River Basin and large scale cultivation of cashew crop adopting modern technology is possible due to assured supply of good quality water from Mhadei River. It is averred that the water requirements for raising of mango grafts and for mango processing industry are met from

Mhadei River and its tributaries.

(li)

The pleadings of Goa continue to state that the yields of rainfed plantation are very meager and scientifically, it has been proved that optimum irrigation right from December to May can double the coconut yields which in turn will have the adverse effect of mite infestation which could be substantially minimized by copious irrigation to bearing nut trees. It is pleaded that the size, copra content and oil content are better in irrigated coconut trees and the water requirement of coconut is very high and a nut bearing coconut tree requires about 60 liters of water every alternate day.

The State of Goa states that the farmers are irrigating their coconut crop by installing irrigation pumps, and drawing water from Mhadei River in addition to Lift Irrigation Schemes of Water Resources Department and the water stress to this crop will result into immature nut fall, reduction in size, copra and oil content. It is mentioned that the crop also becomes susceptible to many pests and

diseases and termite infestation is very severe in water stressed areas which will culminate into substantial

reduction in production and productivity of coconut in the State.

State of Goa states that the coconut based Cropping System with coconut as the main crop, intermixed with Areca nut, Banana, Black pepper, Nutmeg, Pineapple, elephant's foot (Yam), etc. is followed in the State since ages, wherever sufficient irrigation source exist and the income source is assured since failure of any crop is compensated by other crops. There is effective utilization of soil moisture, land, sunlight, air in this system. It is pointed out that the biomass produced is decomposed and becomes rich organic manure, as a result, the soil becomes very fertile and productive.

The State of Goa submits that coconut farming is one of the major activities in the agricultural sector, and it is more prominent, apart from other parts in the state, in and around the Mhadei Basin area which is known for its fertility, and indeed, the volume production of coconuts is almost around 200 million in a year and Goa has around 40

lakh coconut trees in the entire state of which Mhadei

region has substantial share in the same, almost to the extent of 60% as it covers around 7 Talukas which predominantly has agriculture as its main source of economy.

(lii)

The State of Goa has submitted that the ‘Kulagors’ are largely cultivated by the hard-working farmers of Mhadei River Basin which are totally dependent on this river water whereas the spices like Black Pepper, Nutmeg, Cinnamon, Cardamom, Kokum, Turmeric, Ginger are grown here and the spices fetch higher income to the farmers.

The State of Goa states that the value addition to spices have been initiated by many progressive farmers and have achieved greater success. It is mentioned that the White Pepper, Turmeric Powder, Nutmeg periapt pickle, Kokum Syrup, Kokum Candy, Nutmeg lace, etc. are the few examples whereas the coconut based cropping system has provided much needed employment to rural population.

The state of Goa submits that coconut oil is the most health

friendly edible oil.

(liii)

The State of Goa states that the requirement of water is very critical during the planting phase from February to March which sometimes extends up to May also, and another critical phase is maturity phase from November to January, and the water stress during these critical stages lead into crop being subjected to lodging termite infestation which causes significant reduction in yield recovery.

The State of Goa further states that the vegetables are cultivated in Mhadei Basin areas by almost every household who owns even little land and the local vegetables like Bhindi, Cucumber, Chili, Cluster bean, Brinjal, Yam, etc. are cultivated in Kharif and Onion, Red Amaranthus, Radish, Palak, Wal, Brinjal, KnolKhol, Chili, Watermelon, etc. are cultivated in Rabi season, whereas the summer cultivation of Bhindi and Leafy vegetables is also done in some areas. It is mentioned that the Rabi and summer vegetables are irrigated from dugout ponds, wells and irrigation projects, Lift Irrigation Scheme and Mhadei River.

The State of Goa states that being short duration crops, they fetch immediate returns to the grower in addition to their own consumption.

The State of Goa states that as the root system of these crops is very fragile, they cannot withstand water stress or increase in water salinity and the crop physiology gets disturbed and the crop growth is adversely affected.

The State of Goa states that the flowering, fruit set and fruit quality are affected and the yields are drastically reduced.

(liv)

The State of Goa maintains that the Mhadei Basin areas are known for the aroma of local flowers like Jasmine (Jayo, Mogra), Crossandra (Ratan Aboli), Chrysanthemum, Champaca and Marigold which the locals grow them in their backyard, as these flowers are valued very much and in

demand throughout the year and of late, high value flowers like Roses, Gerbera, Chrysanthemum, Carnations are commercially grown under the protected cultivation. According to the State of Goa, the local flowers are a source of livelihood to rural population who grow them in their

backyard and the source of irrigation is dugout ponds, wells and Mhadei River and its tributaries.

(lv)

The State of Goa states that rice is one of the important components of “fish curry rice”, which is the main staple food of the majority population of the State, largely cultivated in Ker lands, Morod lands and Khazan Lands during Kharif season and for this reason, agriculture and rice cultivation, as well as supply of fish is required to keep pace with the increasing population, but any depletion of the water level in river Mhadei will necessarily cause depletion of marine resources, as well as an adverse effect on the agriculture, which includes rice cultivation. It is stressed that this will therefore, not only violate the basic fundamental, and human rights of the population of the state but will affect the standard of living drastically as well as create a vicious circle of disastrous consequences. According to State of Goa this food pattern is a nature based phenomena in as much as, the gastronomic pattern

as well as the system of body metabolism is fully dependent on this naturally supported diet, which is not only regarded as healthy, tasty, but also a well-accepted pattern of diet in

the coastal areas, as well as this region of Mhadei Basin. It is mentioned that the Rabi crop is possible in Ker lands wherever sufficient irrigation facility exists and some innovative farmers have even taken three crops in a year in the past. ‘Puran Sheti’ is done in Rabi season in Sattari Taluka, namely utilizing water from Mhadei River.

The State of Goa states that the local varieties of Paddy have been replaced by high yielding varieties and hybrids and the System of Rice Intensification (SRI) method is adopted in Mhadei Basin region which has increased the paddy yields by 25-30%.

The State of Goa states that the total Rabi cultivation of paddy is dependent on Mhadei River water and if the availability of this water is jeopardized, the cultivated area and production will be drastically reduced.

(lvi)

The State of Goa states that if the sweet water natural flow is diverted or minimized, it is apprehended that during the high tide, the sea water will rise further to fill the void

created due to reduction in the quantum of water in the

river and the sea will maintain the equilibrium by pushing the saline water further, thereby bringing more fresh Water Zone under the ambit of saline water. The State of Goa states that this will increase the salinity level of Mhadei River in the hinterland, and the seepage, streams will further pollute the fresh water ponds, wells and increase their salinity levels. It is pleaded that the basin areas will be subjected to saline water intrusion due to breaches in protective bunds in this region and this will further transform fertile lands into Khazan lands and invite associated problems in new areas. It is explained that, if such lands are left fallow, the mangroves will immediately take over and pose threat to agriculture development in this region.

The State of Goa states that one of the serious problem associated with increased level of salinity and water stress is the built up of some of the major pests and diseases that are averse to agriculture development.

(lvii)

The State of Goa states that the incidence of black headed caterpillar is experienced more in coastal and saline belt

and this pest totally damages the coconut leaves and they appear to be naked. The yield drastically reduces.

The State of Goa further states that the incidence of termites is more when the soil moisture gets depleted and these termites affect the root system and stem part in coconut, cashew, mango, banana, pineapple, sugarcane crops. The State of Goa states that the coconut damages due to mite infestation is severe due to water stress in summer months but a good management practices including irrigation will minimize the damages due to mites, provided there is sufficient water in the Mhadei river.

The State of Goa states that the incidence of stem bores early shoot borers white woolly aphids, mealy bugs and scale insects in sugarcane is on the rise in water stress areas and Root Gruba, Rodents are more prevalent in drier areas as compared to moist areas.

The State of Goa states that in paddy cultivation, Armyworm, Hairy Caterpillar, Caseworm, Leaf folder, Gall

midge, etc. are more rampant and devastating when dry spells during monsoon are experienced.

The State of Goa maintains that if the crop is irrigated by providing life-saving irrigation, the crop damages can be reduced substantially.

The State of Goa states that the Khazan lands in the State are basically lands reclaimed by ancestors for centuries and are located along coastal alluvial plains of rivers, estuaries, etc., and network of massive external and internal bunds are constructed to protect, these Khazan lands from saline water intrusion.

(lviii)

According to the State of Goa, the Mhadei River in the State generally flows through Taluks, namely Sattari, Bicholim, Bardez, Tiswadi, Ponda, Sanguem and now Dharbandora and these Talukas contribute to 1300 Ha of Khazan lands.

(lix)

The State of Goa maintains that if the Mhadei River is diverted, then salty sea water will increase and Khazan

lands will be affected due to seepage of the sea water and

even the salinity tolerant crops will not survive. It is stated that besides, fresh water table being affected by increased salinity, cultivation in Rabi season, including pulses will not be possible, and by diversion of Mhadei water, the fresh water Paddy fields will be transformed into khazan lands, thereby losing their fertility and yields. It is maintained that this will also encourage the growth of mangroves, thereby reducing the present command, and the diversion of Mhadei, thus will lead to wide spread of salinity in the khazan lands that will not only pollute wells, ponds, lakes, etc., but will render land unfit for cultivation. Hence, the State will permanently lose these lands which are evolution of labour works of our ancestors for hundreds of years.

It is emphasized that all these activities, are completely dependent, on the continuous flow of water in river Mhadei, and the requirement for all these activities of water is very high.

It is maintained that indeed, any reduction of water flow in Mhadei river will make the entire region very

severely water stressed thereby not only affecting the

production and productivity of agricultural products but also the general crops, flora and fauna, and in fact, none of the tributaries in the region can, in any way help, make good the situation as most of these tributaries attain salinity after a particular level.

(lx)

The State of Goa has asserted that all these activities are basically in the primary sector, and a huge network of workmen, farmers, persons belonging to lower income group, landless labourers, etc., who are heavily dependent on these activities and there is therefore direct and indirect dependence on the continuous flow of water in the Mhadei River. It is, thus, emphasized that in these circumstances, ignoring the rights of the persons living in the riparian states, surely, Karnataka cannot be allowed to divert the waters to another region, for the purpose of augmenting the sugar cane cultivation, through the so called camouflaged requirement of irrigation purposes, to the severe detriment of the settlements within the Mhadei

basin.

The State of Goa submits that there shall be tremendous increase in unemployment in the State of Goa as people would lose their source of livelihood on which they are squarely dependent for several decades and probably through ages, and this in turn will give rise to loss of income and employment, and further breed inequalities in living and habitation, within the population in the region and will give rise to vicious economic cycle leading to poverty, having very severe social consequences and may even give rise to chaos and disorder in the society.

(lxi)

It is asserted by Goa that all these activities are possible, and essential for survival and sustainability of flora and fauna, micro-organism, only if a particular flow of water level is maintained and in the same existing particular flow of water level particular organisms will grow, maybe for a particular time and die, survive and get eliminated, but this is a cycle of nature supported by the various factors in the cosmos, countenanced by Mother Earth.

It is pleaded that any decrease in the level of the flow of water will severely affect the flow, the life factors,

lifecycle, migration, food requirement, flora and fauna, habitation, breeding locations, seasonal migration, endangered species, and disturbances in life cycle requirements apart from the cascading effect generally on the environment as well as aberration of the protected ecosystem.

(lxii)

The State of Goa also wishes to point out that the so-called encouragement which the state of Karnataka gives to the sugarcane cultivation, and on which spacious ground for irrigation purposes, Karnataka wants diversion of water, which at one point of time was feigned as drinking water purpose, has now been admitted after state of Goa exposed Karnataka's intentions.

(lxiii)

According to the State of Goa, the whole of Sattari taluka depends on the waters of Madei for its agriculture including the centuries old method of ‘Puran Sheti’ and the Vasant Bandaras - lift irrigation employed by most of the villages. It is mentioned that these 27 odd villages will face a total ruin and Khazan lands are saline floodplains covering an area of about 17,500 Ha which have been reclaimed over centuries,

(Historical records of the 6th century mention Khazan lands), by constructing an intricate system of bunds (dykes) and sluice gates. It is pleaded that Khazan lands are ecologically, economically and socially very important for agriculture and piscine culture and this unique system is based on the ecology of the area that includes the present level of salinity of the water. It is asserted that about 2,000 Ha are under dense mangrove vegetation and the mangroves help to protect the outside of the mud and laterite bunds, that enclose the Khazan. Mussels, clams, oysters, crabs and prawns are harvested, and the fish and shellfish sustain a large population of indigenous and migratory birds.

It is emphasized that reduction in fresh water flow will push up the salinity to a much higher level which may result in the Khazan lands becoming unproductive, affecting thousands of people depending on the Khazan lands and as a result of shortage of water, staple produce of rice, pulses and cereals may get affected. It is stated that the the

plantation crops such as cashew, coconut and areca nut which are largest plantation crops in Goa are bound to

suffer because the largest area of cashew plantations is located in the Madei/Mandovi river basin in the talukas of Sattari, Bicholim and Bardez. It is informed that the area under areca nut is 2,000 Ha and almost half of it is in Ponda taluka whereas other plantation crops grown in Goa are the bamboo, the banana and mango, bhirand or kokum. Kokum is also an important plantation crop which forms a part of daily diet and is used as a garnish to give an acidic taste to curries and vegetable as well as in the preparation of cooling kokum syrup during the hot summer months.

(lxiv)

According to the State fishing is a major industry in Goa and over 40,000 people are dependent on fisheries for their livelihood. It is informed that out of 12 talukas of the state, fisherman from 8 talukas are involved in fishing and fish curry and rice is a staple food of Goan people. It is stated that the inland catch from the rivers in 2009 was 3,283MT as against the total catch of 83970 MT (2009) and there are landing centers for inland fisheries all along the banks of the

Mandovi. It is asserted that the reduction in the water level and the deeper ingress of salt water will affect the fishing due to barriers to fish migration and this will reduce the fish

catch. According to State of Goa, the tourism industry in Goa depends on the local fish produce as well as flora, fauna, vegetation etc., which will definitely face problems. It is pointed out that the mangroves also will be affected and the shellfish breeding will be depleted and the aqua farms along the river banks also will face problems. (lxv)

The State of Goa submits that the Mhadei plains of Goa comprise an intricate system of wetlands, tidal marshy areas, and cultivated paddy fields (khazans) all intersected by canals, inland dykes, bays, lagoons and creeks and the Mhadei River and its backwaters in the hinterland are governed by regular tides, which are felt up to 46 km., upstream. It is pleaded that the physicochemical conditions in the Mhadei River are influenced by two factors, viz. fresh water run off during the monsoon season, and the tidal influx of coastal water. It is pointed out that the Mhadei River is a tidal estuary which acts as an extended arm of sea with tidal sea water intrusion, and the fresh water flow

keeps the salinity at certain acceptable levels. The State of Goa submits that this unique combination has resulted in a

manifestation of a unique and a completely fragile and highly sensitive aquatic eco-system and as such, it is highly dependent on the delicate balance of intrusion of sea water along with the mixing of fresh water thereby maintaining a very fine salinity level and such a delicate aquatic eco-system is completely unique and is completely dependent on the two forces of nature acting in tandem. The State of Goa states that any disturbance to either of the two forces of nature will have a massive repercussion on this aquatic eco-system thereby destroying the entire eco-system. Accordingly, it is asserted that the reduction in fresh water flow in the Mhadei River as a result of abstraction of water from the river, whether for trans basin or inter basin diversion or for within the basin use by the State of Karnataka and or by State of Maharashtra will have devastating and detrimental effect on the Goa's entire eco - system, unique mangroves, agriculture and fisheries.

The State of Goa maintains that the Mhadei River supports rich and diversified flora and fauna and as far as

the Fishing Industry is concerned, it is a complex mix of

artisanal, subsistence and traditional fisheries with diverse species, fishing gears, migratory fishers and fish merchants. It is pleaded that the estuarine complex of Mhadei River is the most prominent and supports a wide variety in terms of nursery and breeding grounds.

(lxvi)

The State of Goa submits that the entire Mhadei River has a favourable coastline and equitable climate throughout the year, and the growth of mangroves along the coasts, as well as brackish water bodies, are influencing the growth of fish fauna on an unprecedented scale. Resultantly, it is pleaded that the State of Goa has a rich fish species diversity thereby sustaining a large Fishing Industry.

The State of Goa submits that Mhadei River is reported some to inhabit large number of species of fish, and of these species are Mugil cephalus (Mullets), Gerres filamentosus (Whipfin silver biddy), Gerres limbatus

(Saddle back silver biddy), Sillago sihama (Silver whiting),

Etroplus suratensis (Pearl spot), Arius-arius (catfish),

Lutjanus

argentimaculatus

(Mangrove

red

snapper),

Lutjanus russelli (Russell's snapper), Lutjanus fulviflamus

180

(Dory

snapper),

Lutjanus johni (John snapper),

Acanthopagrus berda (Seabream), Elops saurus (Lady fish),

Engraulis encrasicolus (Anchovy), Chanos-chanos (Milk fish),

Megalps

cyprinoides

(Tarpon),

Scatophagus

argus

(Scatophagus),

Ambassis

gymnocephalus

(Ambasis),

Sardinella longiceps (Sardines), Escualosa thorcata (White

sardine),

Galaxias

maculates

(White

bait),
Gerres
subfasciatus (Silver bellies), Leiognathus bindus (Orange fin
pony fish), Leiognathus daura (Golden stripped pony fish),
Pempheris
canaliculatus
nebulosus
(Yellowfin
moluca
(White
(Spangled
tuna),
(Molucam
spotted
sweeper),
foot),
Siganus
Lethrinus
albacares
tuna),
spine

emperor),

Thunnus

Thunnus

tonggol

(Longtail

Dendrophysa russelli (Goatee croaker), Psettodes erumei

(Indian

spiny

turbot),

Tenualosa

toil

(Toli

shad),

Anodontostoma Chacunda (Chacunda gizzard-shad), etc.

The State of Goa further states that various varieties

of Penaeid shrimps present in the river are Penaeus

monodon (Tiger prawn), P. Semisulcatus (Flower prawn), P.

indicus (White prawn), Penaeus Merguiensis (Banana

prawn),

Marsupenaeus

japonicus

(Kuruma

shrimp),

Metapenaeus affinis (Jinga shrimp), M. Dobsoni (Kadal

shrimp), M. Monoceros (Brown shrimp), Parapenaeopsis stylifera (Kiddi Shrimp). Shell fish and Crabs species include Charybdis cruciata (sea crab), C. Incifera, C. Feriotus, C. Natar, Portunus sanguinolentus (Three spot swimming crab), P. Pelagicus (Blue swimming crab), Matula lunaris (Sandy shore crab), Scylla serrata (Mud crab) are also found in Mahadayi estuary.

Furthermore, it is stated that Bivalves, such as Placuna placenta, Vilorita cyprinoids, Meretrix-meretrix, Meretrix casta, Paphia malabarica, Papiha textile, Catelysia opima and Marcia opima are also part of this fragile and sensitive acquatic eco-system. Gastropods such as Bursa sp, hemifusus sp, tibia-curta, Telescopium, Natica, Trochus radiates and many more are available.

According to State of Goa, Oysters species such as Crassostrea madrensis (Indian oyster), Saccostrea cucullata (Hooded oyster), and Mussels such as Perna viridis (Green mussel), freshwater mussel, are also present in the river. Cephalopods such as Sepiella inermis (Spineless cuttlefish),

Sepia pharaonis (Pharaoh Cuttlefish), Panulirus polyphagous (Mud spiny lobster), Thenus orientalis (Sand lobster),

Panulirus sp., (Spiny lobster), Loligo duvaucelli, Loliolus investigatories and Octopus dolfusi, etc. are available in this River System.

(lxvii)

The State of Goa states that some of these varieties and species of fish are exclusive to the aquatic Riverine eco-system of Mhadei River and as such, these fish varieties are completely dependent on a fragile aquatic eco-system, which is largely dependent on the fine balance of sea water and fresh water. The State of Goa emphatically submits that any such proposed abstraction/storage/dam/ diversion would cause a change in the natural flow regime of the river and will critically endanger all the precious and other species as a result of their habitat being destroyed, and also the physicochemical changes to the water in the River System.

(lxviii)

The State of Goa submits that the annual inland fishing catch in the year 2013 was approximately 4,678 tonnes and

the catch is brought to various fish landing centers by the fishermen and finally, this large variety of fish finds its way into the local markets all over Goa as well as the country.

183

The State of Goa states that fishing is one of the chief occupations and the source of livelihood for the people living in the State of Goa and for a population of roughly 1.5 million local residents, fish is a staple diet, and provides a source of rich protein food. Furthermore, it is informed that fish assumes greater significance to the people of Goa, as it forms one of the most important items of food of more than 90% of the population. What is stated is that, in fact, fish forms an integral part of Goan life and that fish and rice together form a staple food. It is informed that the ‘Xit Coddi’ (Fish Curry Rice), which is an important dish, is invariably a part of the daily meal in every Goan household and per capita/fish consumption in Goa is 7.4 kilograms, as against the national average of 5.00 kilograms, which points to the importance of Fishing Industry in the State of Goa.

lxix)

The State of Goa submits that there are a total number of 30,225 fishermen in the State of Goa, out of which 11,944 are active and occupational fishermen and additionally,

there are 1,82,821 fisher folks engaged in allied fishing activities including marketing of fish and other ancillary work. The State of Goa states that women outweighed men

in fishing activities in the State of Goa and as a matter of fact, out of 12 Talukas in the State, 8 Talukas are involved in fishing, which is an important economic activity, a source of livelihood for a large number of people. It is again stated that fish also constitutes a rich source of proteins particularly for poor people, and which is also the staple food for the people of Goa, and fishing activity is carried out in the sea, as well in the inland waterways, of which the Mhadei is a major river.

The State of Goa states that inland fishing is mainly carried out with the help of mechanized and non-mechanized/traditional crafts and in Mhadei River, fishing is carried out mostly in the creeks either by cast nets, river gill nets and barrier nets, etc. It is stated that additionally, fishing is also practiced with the help of stake nets, which form an important inland fishing activity and that such fishing activity in Goa is carried out throughout the year except the time of high tides during the monsoon season. (lxx)

The State of Goa submits that, the near shore areas of the coast of Goa are highly influenced by the Mhadei River

system, as the same eventually drains into the Arabian Sea making it nutrient rich fishing zone. It is stated that this fishing is done by traditional fishermen with the help of gill nets, hook and line, rampo normal nets, etc. It is explained that the gill nets are mainly used for catching large size fishes like sharks, seer fish, pomfrets, skipjack, etc. whereas cast net fishing is done individually with a boat and a net. It is stated that fishing by hook and line is carried out during the peak fishing season. The State of Goa submits that a total number of 1385 gears are registered in the State of Goa, out of which more than 50% are the likes, which are used in inland fishing. The State of Goa reiterates that a large part of this inland fishing activity is carried along the Mahadayi River Basin, and the same is completely dependent on the delicate balance of salt water intrusion and fresh water flow in the Mahadayi river. The State of Goa emphatically states that any change or reduction in the flow of water even to the minutest scale will result in complete destruction of the wide and unique marine flora

and fauna as also the industry dependent on it.

(lxxi)

The State of Goa further states that the unique aquatic eco-system, and delicate habitat created in the river system of Mhadei, is due to the delicate balance of sea water and fresh water flow alongside the terrain, which has resulted in a highly specialized eco-system for mangroves, which are basically salt water-resistant plants in inter tidal areas. It is asserted that the total area of mangroves supported by the Mhadei River is spread over about 900 hectares. It is stated that various biotic communities associated with these mangroves form a harbour to some wildlife, as well as to the various aquatic fauna. It is further stated that highly specialized eco-system forms a complex food web, and provides to the needs of not only the local inhabitants of Goa, but also to the various animals including marine fauna, as a part of the food chain. It is claimed that indeed, the luxuriant growth of mangroves around the Mhadei estuarine region plays a major role in prevention from soil erosion, thereby stabilizing and protecting the coast from

heavy wave action and wind.

(lxxii)

The State of Goa submits that a note of these salient features of the Mangroves was taken by the Hon’ble

Supreme Court of India in Indian Council for Environment-Legal Action versus Union of India and others (reported in [1996] 5 SCC 281), including taking a special note of the fact that Mangrove forests in State of Goa need protection as the same stretches for more than 100 meters from the River banks. It is asserted that the entire area is therefore designated as a No Development Zone and no activities are permissible in these areas, as these areas are highly eco-sensitive.

The State of Goa states that the State Government has made valiant efforts in protection of these eco-sensitive areas and all such efforts will be lost in the event there is any reduction in flow of the fresh water in the Mahadayi River. It is mentioned that the delicate balance of salt water intrusion coupled with fresh water flow is the elixir to the sustenance of these Mangrove Forests and in the event the States of Karnataka and Maharashtra are allowed to divert or reduce the flow of water in the Mahadayi river, the same will result in extinction of the wide Mangrove Forests

thereby causing a large-scale havoc on the environment.

The State of Goa has reiterated that the destruction of

Mangrove Forests will result in massive soil erosion along the River Banks endangering various towns and villages along the River Bank.

(lxxiii)

It is submitted that a large number of flora and fauna forage for food on land as well as water and Mangroves swamps are extremely important breeding ground for the flora and fauna and as such, they exist and thrive on the unique and fragile eco-system created in the Mhadei River. It is pleaded that any disturbance to this fragile eco-system will cause wide spread devastation thereby immediate destruction of this unique eco-system. According to State of Goa besides the aquatic flora and fauna, numerous animals use these mangroves as their habitat including certain endangered species including saltwater crocodile, American crocodile, Proboscis monkey, Diamondback terrapin and the crab eating frog.

It is maintained that many fish varieties migrate from sea water to fresh water and vice-a-versa, which is

technically known as Anadromous and Potamodromous, respectively for various reasons, such as food gathering,

breeding and temperature adjustment, etc., in order to complete their life cycle. Explaining in detail, it is mentioned that for example, in the Mhadei river system, sardines migrate in shoals in search of food, whereas Eels species are inhabitants of the river and migrate in large numbers after laying eggs and this unique and fragile eco-system of the Mhadei River sustains all these activities. It is pleaded that in the event, this fragile and unique eco-system is destroyed or altered, there will be a cascading effect on the migratory species which thrive therein for various purposes as mentioned hereinabove.

(lxxiv)

The State of Goa submits that the Mhadei River system is also home to some rare endangered species

and due to

diversion of river water, rich beds of clams, bivalves and oysters may lose a rich diversity of the filter feeding species as well as the fertile beds of lobsters may also be completely destroyed as also the River-Otters, which are a

rare sight now will further also be left without a home. The State of Goa pleads that it may also lose some endangered species of shark such as Rhincodon typus (whale shark), Sphyrna lewini (Scalloped hammerhead), Sphyrna zygaena

(Smooth hammerhead shark) and the coastal nesting habitats of turtles such as Lepidochelys olivacea (Olive Ridley) will also get destroyed. Furthermore, it is claimed that the freshwater pearl mussel, Margaritifera-margaritifera and Window pane oyster i.e. Placenta-placenta, which are also endangered species, may also widely be affected.

(lxxv)

It is averred that on the aspects of ecology, environment, flora and fauna, fishes and fisheries, fishing industry, a large number of endangered species of birds and animals etc., and the drinking and irrigation needs of its people and other requirements which have been noticed above, the State of Goa, therefore in its conclusion on those needs,

states that the Mahadayi river is a lifeline to the State of Goa, more particularly to support the vast inland fishing activity, as well as for sustenance of vast flora and fauna, including the unique aquatic eco-system. Thus, it is emphatically submitted that any diversion of the waters of Mhadei River will have massive repercussions on the inland fishing activity, as well as destroy the endangered and very fine aquatic eco-system. It is avered that the destruction of

the inland fishing will have cascading effect on the other industries connected thereto including industries related to jetties and wharfs, jetties used for berthing of fishing vessels, workshops involved in repair, maintenance and construction of small ships which are located on the banks of the river will get hampered, thereby causing large scale devastating effect in the State of Goa, including destruction of traditional activities. According to Goa, not only the damage to the mangroves will be catastrophic, but same will also be disastrous to the flora and fauna, and the ecologically important organism be destroyed, and such rich flora and fauna will forever be lost, in addition to hampering Goan people directly as well as indirectly.

(lxxvi)

The State of Goa points out that Karnataka's project, with as many as 11 dams to be located within an area of 50 km., radius, has been planned in an area much prone to earthquakes and two large dams - Supa reservoir and Codasalli are just 50 and 35 km., away, respectively, from

the Mahadayi project area. It is pleaded that since the project areas are bordering Goa, Goa will also be very vulnerable for any seismic disturbances.

The State of Goa apprehends that setting up of similar Projects by the State of Maharashtra, possibly emboldened by the unfortunate attempts by the State of Karnataka would be disastrous. According to Goa, the two States of Karnataka and Maharashtra, taking undue advantage of their respective geographical positions, and the vast economic resources at their command, if permitted to alter the profile of the river basin, and divert the waters outside the river basin, will pose a very serious threat to the very sustenance of the State of Goa and its people.

According to Goa, the States of Karnataka and Maharashtra are bent upon altering the profile of the Mahadayi river basin, taking advantage of their dominant, geographical and economic positions, and the two States are bent upon diverting waters from Mandovi river/river basin, outside the basin area and this will result, not merely in the complete destruction/extinction of the river/river basin, but possibly the State of Goa and its peoples. (lxxvii)

It is vehemently pleaded by Goa that the State of Karnataka, in particular, is making, and has made, several

attempts to alter the river profile, and to divert the waters from out of the Mandovi river basin to beyond and in the aforesaid regards, a reference is made to the following:-

(a)

In the past the State of Karnataka had made attempts to alter the profile of Khandepar and Dudhsagar (Katla and Palna) tributaries of the Mandovi River, which originates in the State of Karnataka and joins Madei River in Goa to form Mandovi River in Goa State. An attempt was made to divert the waters outside the Mahadayi water basin into Kali Nadi basin.

(b)

The State of Karnataka proposed outside the basin diversion of Mahadayi river by formulating a "Mahadayi Hydel Scheme". As per this scheme, the main storage was proposed at Kotni on Mahadayi River and series of small storages on its sub-tributaries to Katla and Palna. This involved, inter alia setting up of Kotni Dam, Irty pickup weir, Tailrace Dam, Bailnadi

Dam and diversions from Murudhaul Nalla, Pansher Nalla and Andher Nalla. This scheme proposed diversion of waters from Mahadayi river to Malaprabha river basin.

(c)

Outside the basin diversion of water from Kalasa and Haltar Tributaries to the sub-basin in Krishna basin. This involves interception of 4 sq.km. of Haltar Nalla in Karnataka by a Dam. Haltar Nalla after leaving Karnataka, enters into the State of Maharashtra and thereafter the State of Goa forming the Valvanti River which is the major tributary of Mahadayi river. The proposal is to divert water from Haltar Nalla to Kalasa Reservoir by an open channel to the Malaprabha sub-basin. This outside the basin diversion will affect the water supply at Sanquelim headwork and also lift irrigation schemes in Valvanti river,
all within the
Mahadayi river basin. Further, a dam is proposed at Kalasa Nalla and Surla stream. Surla is the tributary of Mahadayi River. About 302 Hectares of land which includes 183 hectares of forests will get submerged due to Kalasa reservoir.

(lxxviii)

It is asserted that the aforesaid attempts will seriously affect the very sustenance of Mahadayi River and its basin and will also adversely affect the very sustenance of the State of Goa and its peoples. It is averred that the projections, insofar as

Kalasa reservoir put forth by the State of Karnataka, are grossly defective, unilateral and exaggerated. It is pleaded that in fact, the proposal if given effect to will result in submergence of 302 Ha of land, out of which 183 Ha., will be forest and Part of Goa – Belgaum road via Chorla Ghat will be submerged. It is stated that the road connecting Surla Village of Goa to the main road will also get submerged and all this is proposed by the State of Karnataka without even considering the disastrous effect on the State of Goa or without obtaining any consent from the State of Goa. It is pointed out that the objective is to divert waters into the Malaprabha reservoir through an open cut channel by undertaking rash engineering feats of changing alignment of the topography. The details are being deliberately withheld and the entire attempt is to create a situation fait accompli. (lxxix)

It is mentioned that to study the Karnataka proposals about diversion of water from Madei Basin to Malaprabha River, a Panel of Experts (PoE) was appointed by Govt. of Goa on

14th February 2000 and the PoE has reported that total 75% yield from the whole of Goa Region of the Mandovi/Madei Basin is 86.80 tmcft. (2460 Mcum), whereas the Water

Resources Yield from the western and the central regions will not be available for full scale developmental use, because of the present land Use and non-availability of suitable storage sites and other civic and industrial developments, which have already taken place in the region, and on account of existence of salinity zone. It is pointed out that even presuming that the full water resources from Karnataka and Maharashtra and the foothill regions of Goa becomes available to Goa state for use, the total availability of water resources for developmental purpose could be only 54 tmcft. (1531 Mcum), as against need of water in the Mandovi river basin for Goa alone would be to the tune of 92-95 tmcft. (2600-2700 Mcum), thus the Mandovi Basin is a water deficient basin, and as such there is absolutely no scope for any diversion of water outside the basin to Malaprabha river. It is informed that the same was communicated to Hon. Chief Minister, Government of Karnataka vide D.O Letter dated 21.03.2000 from Hon. Chief Minister, Government of Goa.

(lxxx)

According to State of Goa during the months of May/June 2000, it came to the notice of the Goa Govt., through news

items in the newspapers, that the Govt. of Karnataka had approved the proposal of the Kalasa project on the Kalasa Nalla near Kanakumbi and the Bhandura Nalla project near Nerse on the Bhandura Nalla (both in Khanapur taluka of Belgaum district in Karnataka State) for Rs.93.27 Crores and these projects were stated to be planned to divert 3.34 tmc of water from Kalasa project and 3.2 tmc of water from the Bhandura Nalla project to Malaprabha project in Krishna basin.

(lxxxi)

It is averred that the scheme envisaged construction of 86.5 mts. high storage dam across river Mahadayi downstream of confluence of Kotni Nalla, a 62 mts. High dam across Bailnadi, a 44 mts. high pickup dam across river Mahadayi downstream of confluence of Irti Nalla, a 25 mts. high-tailrace dam across Mahadayi river near State border and other ancillary works and power house. Under this scheme it has been proposed to divert about 4 tmcft (113 Mcum) of water from Madei River through a link tunnel to the

Malaprabha River to meet the irrigation deficit of Malaprabha project. It is pleaded that this project report was examined in CWC and it was suggested that, Mahadayi

being an interstate river any diversion of water to the Malaprabha river basin in Karnataka, concurrence of Govt. of Goa was necessary as downstream flow in Goa may be affected by such diversion.

It is pleaded that the above letter of 03.11.2000 from the CWC also enclosed a copy of the note from the Director (HAD), Central Electricity Authority forwarded to the CWC by the CEA and the note states as under:

(1)

In context with this, it is stated that DPRs of the above referred Kalsa project and Bhanduri Nalla projects have not been received by the CEA.

(2)(i) KPCL, however submitted two schemes viz. Katla and Palna diversion scheme and Mahadayi HE projects (345MW) located in Mahadayi basin to CEA for approval.

(ii) The Katla and Palna scheme was submitted by the KPCL to CEA in Nov 1985. The scheme was returned to KPCL by CEA during October 1987 since the project

involved inter-state aspects with Goa.

(iii) The DPR of the project was received in August. 1991. However, due to interstate aspects with Goa, the report was returned to KPCL in March, 1992, with the request that the report could be resubmitted after the resolution of the interstate aspects.

(lxxxii)

It is informed that in the meantime, eyewitness accounts and reports received from the local inhabitants of the project areas indicated that the Karnataka Govt. was making systematic efforts to start the schemes causing concern and, therefore, the Chief Minister of Goa took up the matter with Chief Minister, Govt. of Karnataka, vide D.O. letter dated 14.12.2000 26 , reiterating that the Govt. of Goa strongly objects to the taking up of any projects for outside-basin-diversion of water from Madei basin. He requested the Govt. of Karnataka to stop the project construction immediately.

(lxxxiii)

It is pointed out that the State Govt. of Goa also took up the

matter with Govt. of India stating that Govt. of Goa strongly objects to taking up of these projects, since these projects are located in Madei basin, vide DO letter dated

14.12.2000, Goa being a lower riparian State of which a large part falls in the Madei basin, its water resources are vital for the survival and sustenance of the people of Goa, and hence, the Govt. of Goa has serious reservations and objections for these Karnataka projects involving diversion of water outside Basin of Madei River. It is mentioned that further, the Govt. of Goa requested the Ministry of Environment & Forests, Govt. of India, not to clear any project for use of water from Madei river basin by the State of Karnataka without obtaining concurrence from the State of Goa.

(lxxxiv)

It is pointed out that on receipt of the intimation from the Govt. of Goa, Advisor, Water Resources, Planning Commission, Govt. of India wrote a 1etter dated.9.3.200140 to the Chief Secretary, Govt. of Karnataka, with copy to Commissioner (PR), MOWR, Govt. of India and Secretary (Water Resources), Govt. of Goa, wherein he pointed out: “As per the Planning Commission’s letter

No.16(12) 99-WR dated 30th November, 200041 (copy enclosed) before any major and/or multipurpose and medium irrigation project as

well as flood control including drainage project that has “interstate ramifications” is taken up for execution, such project/scheme is required to have the investment clearance from the Planning Commission after its techno-economic appraisal in the CWC/Technical Advisory Committee of Ministry of Water Resources. It is learnt that the matter of sharing waters of the above river remains yet to be resolved amongst the basin States.”

Further, it has also been stated that “both these projects, located in the head reaches of Madei/Mandovi River in Karnataka, would divert water into Malaprabha sub-basin (a part of Krishna River basin)”.

Further it was requested to send “the present status of the above two projects, particularly with regard to investment clearance/approval.

The “in principle” hasty clearance accorded by the CWC/MOWR on 30.04.2002 42 is therefore glaringly in contrast to the principled stand they had themselves taken earlier in 2001.”

(lxxxv)

According to State of Goa, in response to a D.O. letter written to the Prime Minister of India by the Chief Minister of Goa, dated 19.2.20014 and another letter to Union Minister for Water Resources, by the Chief Minister of Goa,

the Central Water Commission (CWC) convened the first Interstate Meeting on 18.4.2001 under the Chairmanship of Member (WP&P), CWC, to discuss the projects proposed to be taken up by the Govt. of Karnataka in Madei/Mondovi river basin and the the Inter-State Secretaries (W.R./Irrigation) of Govt. of Goa, Govt. of Karnataka and Govt. of Maharashtra were invited for the meeting.

(lxxxvi)

It is informed that the first Inter-State Meeting was fixed for 18.4.2001 but was postponed at the instance of Karnataka and the Goa team, which had already reached Delhi to attend the meeting, expressed their concern and protest

and the Govt. of Goa earnestly requested the Govt. of India to prevail upon the Govt. of Karnataka not to unilaterally proceed ahead with the projects and hold an interstate meeting immediately.

It is stated that the Secretary, Ministry of Environment and Forests, Govt. of India was also informed that as per the ground realities gathered at Bhandura Nalla project site at Nerse and Kalsa – Haltar Project, Kankumbi, it was apprehended by Goa that the Govt. of Karnataka was

making massive preparations for starting the projects, without obtaining the necessary statutory clearances from MoE&F and was proceeding ahead with the work. It is averred that, therefore, the MoE&F was requested to take necessary steps to restrain Govt. of Karnataka from going ahead with these projects without obtaining the concurrence from Govt. of Goa and Statutory clearances as required from the environment and forest angle so that the interest of the State of Goa was protected.

(lxxxvii)

It is informed that the first Inter-State meeting was held on 29.5.2001, and the minutes of the aforesaid first Inter-State meeting were received from CWC, vide letter dated

1.6.2001. As the said minutes were not correctly representing the full details of the discussions, the Govt. of Goa sent a letter, dated 21.6.2001, giving correct details of Discussions, and further a letter was sent by Govt. of Goa to the Director, Hydrology (South) Directorate, CWC vide letter dated 9.7.200152 to expedite and call for a meeting of the Study Group constituted in the first meeting to proceed ahead with correct yield studies of the Mandovi river basin.

(lxxxviii)

It is mentioned that during the interstate meeting on 29.05.2001 the Chairman requested Govt. of Karnataka not to take up the work pending completion of studies/clearance from Central agencies and it was decided that a Hydrological Study Group under the Chairmanship of Chief Engineer (Hydrological Studies), CWC, New Delhi, with representatives of NWDA, and the three co-basin State Govts. will carry out hydrological studies for assessment of yield of Madei/Mandovi River. The Hydrological Study Group was to submit its report within 3 months.

It is pleaded that the first meeting of the Study Group

under the chairmanship of Chief Engineer (Hydrology), CWC, New Delhi was held on 13.10.2001 at the Office of the Chief Engineer, WRD, Government of Goa, Panaji, Goa and in terms of the decision at the first Inter-State meeting of 29.05.2001, it was agreed that the Interstate Study Group had to submit a Report. The Chief Engineer (Hydrology), CWC, who was the Chairman of the Study Group did not even convene any meeting of the Interstate Study Group, much less call for any Report. Rather, at this meeting, the Chief Engineer, CWC,

produced

a Yield Study Report,

unilaterally prepared by its Hydrology Directorate, ignoring entirely the previous decision of involving Interstate Study Group.

What is informed is that the minutes of the first meeting of the Studies Group held on 13.10.2001 were circulated, vide letter dated 22.10.2001. In this meeting the CWC presented yield studies carried out by CWC with only the assistance of NWDA and Director (Hydrology) (South), CWC, New Delhi and after the presentation, detailed deliberations were held on the various aspects of the CWC study. It is mentioned that in this meeting the representative of Govt. of Goa circulated their reservations and comments on the CWC study, detailing the errors and inadequacies of the CWC study.

It is pleaded that after the receipt of the minutes of the first meeting of the Study Group, the Govt. of Goa had sent detailed comments on the aforesaid unilateral study carried out by CWC.

It is pointed out that the Study Group for the yield of Madei river basin, held its second meeting on 11.01.2002 at Bangalore. Some clarifications had been received from the NWDA, vide their letter dated 4.1.2002 61 and the Govt. of Goa requested NWDA to supply the full and correct data, as requested earlier vide its letter dated 13.11.2001, and also letter dated 18.1.2002 and the notes were circulated by Goa in the said second meeting of the Study Group at Bangalore.

(lxxxix)

It is pointed out that the minutes of the 2 nd meeting of the study Group were circulated by CWC vide letter dated 22.01.2002.

Extracts of these minutes have been transcribed as:

“Chief Engineer, HSO while welcoming the members and associated officers mentioned that now each member of the study group is fully aware of the issues of concern of all the co-basin states. After the first meeting at Goa the views of

all members are clear and this must help in finalizing the study early. It is mentioned that the agenda items, which were circulated in advance, were taken up for discussion.”

207

According to State of Goa, the following paragraphs gives the outcome of the discussions:

(a)

Director, Hydrology (S) requested the members to identify the rain gauge stations, which the co-basin states propose to be considered in the study. During the discussions in the first meeting, Government of Goa was of the view to consider only IMD stations. Govt. of Goa now confirmed their view that all the stations for which data is available irrespective of the agency who is maintaining the station is to be used in the analysis. Other members also agreed for the same. While raising the issue of influencing area of each stations Director, Hydrology (S) wanted to know if certain station below some threshold influencing area could be neglected.

(b)

While discussing about the authentication of hydro meteorological data to be used in the study, Chief

Engineer, Govt. of Goa, expressed the following concerns.

The rainfall data for some years and some stations, which they have got directly from IMD, do not match with what has been used in the preliminary study by CWC.

The discharge data at Ganjem is not consistent. The discharge varies significantly for the same gauge level.

(c)

After discussing the approach to the Study, it was decided that rainfall – runoff model at Ganjem can be developed once the rainfall data and discharge data are reconciled, and corrected considering all the stations up to Ganjem.

(d)

While discussing about the period for which the rainfall data is to be used for extending the rainfall-runoff model, CWC in its preliminary studies has proposed to consider the period from 1931 onwards as most of the rainfall stations were operative in this

period, which give a more rational catchment rainfall value. Seventy years is sufficiently good length of series to finalize the yield studies. Government of

Karnataka agreed to this proposition. However, Government of Goa insisted to consider the data for the entire period i.e., 1901 onwards irrespective of the number of stations and their period.

After detailed discussion, no consensus among the participating States could be reached on the period of data to be used for developing the series. It was therefore decided that this would be discussed in the next meeting.

(xc)

Chief Engineer, WR, Govt. of Goa, wrote a letter dated 7.02.2002, to Director, Hydrology (South), CWC, New-Delhi, by pointing out various discrepancies. A letter was also sent to Chief Engineer (HQ), NWDA, New Delhi, on the same date, pointing out those discrepancies.

(xci)

Before the Study Group could even complete the yield study the CWC summoned the 2nd Interstate meeting for 27.03.2002.

The minutes of the second inter-state Meeting, as pleaded by Goa, are reproduced below:

"Item No.1 :To discuss the details and status of projects proposed by Govt. of Karnataka on Madei/Mandovi River particularly two projects (i) Kalsa project near Kankumbi (ii) Bandura Nalla near Nerse.

Chief Engineer (IMO) CWC recalled that in the first inter-state meeting held on 29.5.2001 the representative from Govt. of Karnataka had stated that the present proposals being contemplated by the Government of Karnataka were truncated versions of those planned earlier and also the power component has now been dropped. He, however, mentioned that there was correspondence between the Department of Energy, Govt. of Karnataka and Central Electricity Authority, regarding clearance of Mahadayi Hydro-electric Project and desired to know the current status of the various project proposals.

The representative from Govt. of Karnataka

informed that the Kalsa and Bhandura Nalla projects as planned now do not envisage any power component. The Mahadayi Hydroelectric project for which DPR has already been prepared apart from power generation also involves diversion of water to the Malaprabha basin. He further clarified that the total diversion of water to Malaprabha sub-basin from Mandovi basin is about 9 tmc.

The representative from Govt. of Goa stated that they are not aware of the project proposals, now being contemplated by the Govt.

of Karnataka in Mandovi basin, and requested that the details of these proposals may be supplied to Govt. of Goa.

After discussions it was decided that Govt. of Karnataka may furnish the details of various projects proposed to be taken up in the Mandovi basin clearly bringing out power benefits as well as proposed outside basin diversion etc. under each project.

Item No.2 :Hydrological studies for assessment of yield of the Madei/Mandovi River.

Chief Engineer (HSO), CWC briefly narrated the present status of yield studies carried out for Mahadayi basin and informed that in spite of convening two meetings of the study group on 13/10/2001 and 11/1/2002, the yield studies could not be finalized. He particularly stated that Govt. of Goa is insisting on analysis of rainfall data including the period 1901-1931. Also, they

have reservations about the accuracy of discharge data at CWC G & D site at Ganjem. Goa had also expressed the view that all the studies had to be carried out in the presence of their representatives.

Secretary, Govt. of Goa explaining the view point of Goa stated that the rainfall data for the years 1901 to 1931 have to be included because the above period consists of large consecutive number of distress years. He also stated that

Govt. of Goa should be informed about the period of data, the method of analysis etc. well in advance so that they can convey their views. Director (Hydrology), CWC explained that out of the three stations considered during the year 1901-1931, only one station i.e. Panaji comes within the Mandovi basin and therefore considering all the three stations for purpose of runoff of Mandovi basin may not reflect the correct picture. Chief Engineer, Govt. of Goa stated that CWC discharge data at Ganjem is not correct. Chief Engineer (IMO) CWC refuting this stated that it is wrong on part of the representative of Govt. of Goa to make such a statement and explained in detail the standard procedure adopted by CWC in collection, analysis and processing of hydro meteorological data. He further stated that in case of observational and other errors, necessary corrections are always

carried out at the time of data processing. Chairman expressed his regret that Govt. of Goa has so many reservations on the yield studies and even on the data collected and utilized by an independent expert agency viz. CWC. He indicated that if such doubts exist even in the work carried out by agencies like CWC perhaps the studies cannot progress. Chairman felt that under such circumstances, Govt. of Goa might themselves carry out these yield studies. It was therefore decided that CWC and NWDA would supply all the hydrological and hydro-meteorological data collected and analyzed by

them to Govt. of Goa for carrying out the yield studies. However, he emphasized that Govt. of Goa will have to stick to a reasonable time schedule. Secretary, Water Resources, Govt. of Goa stated that three months period is necessary for completing the yield studies.

Secretary (WR), Government of Karnataka highlighted the drinking water problems in Hubli-Dharwar towns where water supply situation had become precarious due to falling grounds water levels and supply had become possible only once in 10 days or so. He requested that clearance be given for diversion of 7.5 tmc from Madei to Malaprabha reservoir through Kalsa and Bhandura Nalla diversion schemes for supplying drinking water to the twin towns.

Secretary (WR), Government of Goa stated that requirements of the Madei Basin should be first met before considering outside basin

diversion. He referred to the Krishna Water Tribunal Award in this context, where certain restrictions had been placed by the Tribunal on Maharashtra for diversion of Krishna Waters outside the basin. He was of the view that Karnataka should examine other options like diversions from Kali River to meet the shortage in Malaprabha. Since drinking water was the first charge, Government of Karnataka should curtail irrigation supplies at Malaprabha.

In response, Advisor, Government of Karnataka stated that they had examined all options and the only technically and economically feasible solution was diversion by gravity from Madei.

Secretary (I), Government of Maharashtra referred to the KWDT Award as per which Government of Maharashtra has a right to stake a claim on any augmentation of Krishna Waters, by any of the party States. He also expressed apprehension that Government of Karnataka might develop the capacity for higher diversion from Bhandura nala and Kalsa once a storage scheme comes up. Government of Maharashtra also reserved the right for diverting its share of Madei waters. Secretary, Government of Goa also expressed similar apprehensions about the Government of Karnataka developing a capacity for higher quantum of diversions. Commissioner

(Projects) stated that placing restrictions on quantum of diversion was one thing but totally prohibiting any diversion was another. Both Krishna and Narmada tribunals had placed no fetters on Andhra and MP/Gujarat/Maharashtra respectively on using their shares in any manner they liked including use in other basins. The grave situation in Hubli-Dharwad merited immediate attention. The diversion of 7.5 tmc proposed by government of Karnataka could easily be adjusted in the share of the State whenever decided. As regards apprehension of Government of Maharashtra and Government of Goa about

government of Karnataka developing capability for a higher diversion, he stated that the CWC could always check the technical parameters of the proposed diversion to remove such an apprehension. The three states could also consider setting up of River Basin Organisation for Madei, which could inspect works of any of the States and also serve as a vehicle for free exchange of data among the States. According to him, drinking water issues should not be delayed or deferred till the water sharing is decided.

On the request of Chairman, Secretary (WR), Government of Goa promised to take up the request of Government of Karnataka with his State Government at appropriate level.

Chairman requested Govt. of Goa to finalize the yield studies for Mandovi basin at the earliest so that the development in the basin is not hampered and water does not flow waste to the

sea and impressed upon the basin states to frequently meet and exchange requisite information regarding the demands of the states so that water resources of the region could be used optimally by the basin states. ”

(xcii)

It is stated that the Secretary, Water Resources, Government of Goa, sent Goa Government’s comments on the Minutes of the Second Inter-State Meeting, to the Chairman, CWC. Vide letter- dated 16.05.2002, and it was

also brought to the notice of the Chairman, CWC, that even before the minutes sent by him could be examined and accepted by Govt. of Goa, CWC (ISM Directorate), and MoWR, vide their letter dated 30.04.2002, had unilaterally gone ahead and given the so-call ed ‘in - principle’ inter -state clearance of water availability to Karnataka to divert 7.56 tmc of Mandovi waters through Kalsa and Bhandura Nalla projects to Malaprabha sub-basin, without bothering about the resolution of any of the existing Inter-State disputes in the matter. It is averred that this one sided and unwarranted unilateral action of CWC and MoWR, in contrast to their stand so far, had turned the whole Inter-State meeting into a futile exercise and a farce and it was also brought to the notice of the Chairman of CWC that the government of Goa had lost all trust in a fair and equitable resolution of the Inter-State issue with the help and guidance of CWC and MoWR. It is stated that it was further pointed out that in view of the inexplicable one-sided favour and partiality shown to Karnataka’s interests, the in -

principle clearance given in an un-holy haste on 30.4.2002 by the CWC/MOWR, even before assessing correctly the quantity of water available in the Madei basin compared to

basin needs would m ake the diversion by Karnataka a ‘fait accompli’ and shut the door permanently on any possibility of a negotiated settlement and force Goa to seek judicial intervention as available under the Constitution.

(xciii)

According to State of Goa, the Chief Minister of Goa, vide his letter D.O.No.1-2-2002/CM/2461 dated 7/5/2002 to the Union Minister for Water Resources and Minister for Environment and Forests, requested them to take immediate steps to withdraw the “in principle” permission or to keep it in suspension till a concluded agreement between the basin states is reached, or in the alternative the matter be referred to a Tribunal constituted under the ISWD Act, 1956, and that the outside basin diversion proposed by Karnataka affects the availability of water for specific projects in the downstream projects in Goa state, and that one of the projects (Kalsa) would also involve submergence of lands in the Goa State.

It is avered that the Chief Minister of Goa, with a view

to reinforce the efforts already made, sent another letter dated 02/07/2002 to the Prime Minister soliciting his

intervention to direct the MoWR to withdraw the illegal clearance granted to Karnataka.

(xciv)

It is pleaded that repeated efforts were made by Goa, and it persistently demanded through its various communications addressed to the Secretary, MoWR of the Union of India, requesting to withdraw the unjustified and illegal so-called 'in–principle' clearance accorded to Karnataka's project, and to restrain it from proceeding with construction of the project.

(xcv)

According to State of Goa, Secretary (WR) Goa gave notice dated 09.07.2002 to Secretary, Union Ministry of Water Resources, New Delhi requesting appointment of a River Water Dispute Judicial Tribunal under Section-3 of the Interstate Water Disputes Act, 1956 (as amended), setting out there in the entire sequence of events leading up to the

illegal sanction and strongly urging the Union of India to constitute a Tribunal under Section 3 of the ISWD Act of 1956, and pendin g the constitution of the Tribunal, the “in principle” clearance for diversion of water of 7.56 tmc

outside the basin be withdrawn. The matters referred for adjudication and decision in the notice were as under:

(I)

To adjudicate and decide correctly the available utilizable water resources of the Mandovi Basin at 75% dependability at various points in the basin and at Karnataka's disputed project sites.

(II)

To adjudicate and decide the equitable shares of the three co-basin States in the above quantity of water taking into consideration the long term in basin needs of the three States for the beneficial use of water (water supply, irrigation, hydro power generation, navigation, pisciculture and environmental protection etc.).

(III) To adjudicate and decide whether in basin needs to be given priority over any contemplated extra basin diversions and whether there is any surplus left for extra basin diversions after adequately providing for

long term in basin needs.

(IV) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

(V)

To Adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc. from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those Basins.

(VI) To adjudicate and decide specific restrains or restrictions to be placed on the upstream States with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters.

(VII) To adjudicate and decide the machinery to implement the decision of the Tribunal.

(xcvi)

It is mentioned that the Chief Minister of Goa vide a communication dated 09.07.2002, addressed to the Chief Minister of Karnataka reiterated Goa's opposition to Karnataka's projects for outside -the-basin diversions from the Mandovi basin and a similar letter was sent to the Chief Minister of Maharashtra apprising him of Goa's opposition to the diversion proposed by Karnataka.

(xcvii)

It is informed that as a result of these various efforts mounted at different levels, Senior Joint Commissioner (BM), MoWR, vide a communication dated 19.09.2002, ultimately, placed the "in - principle" clearance accorded to Karnataka in abeyance.

(xcviii)

It is mentioned that an Inter-State Meeting on Mahadayi Water Dispute was convened by Minister for Water Resources, Government of India, on 20.12.2002 at New Delhi, and the meeting was attended by the Chief Minister

of Goa, Ministers for WR, Goa & Karnataka, respectively, along with senior officials of the Union Govt. and the concerned States. It is pointed out that during the meeting, Goa brought out that there were considerable variations in

the yield assessments carried out by different agencies like NWDA, CWC etc. of the Madei, and this was due to various factors such as different methodology, different rainfall figures, & observation errors etc. It is stated that fragile ecology of the river in Goa was elaborated and it was stressed that due attention needed to be given to the ecological considerations, while deciding on the shares of the basin states.

(xcix)

According to State of Goa, Secretary MoWR reiterated Goa's stand on the interstate disputes relating to Karnataka's projects in the Mandovi r iver basin and requested for appointment of a judicial tribunal and the aforesaid request was repeatedly reiterated, through various communications.

It is informed that the Chief Secretary of Goa vide his letter dated 07.02.2005 to the Secretary MoWR, Govt. of India, made it clear that it was not ready for discussion in the proposed Inter- State Chief Secretaries' level meeting

on 15.2.2005 on any issues regarding Karnataka's demands and projects for diversion of any quantity of Mandovi River

water outside the basin. It was also made clear that it had not withdrawn its request for appointment of a Tribunal.

(c)

What is claimed is that the Chief Secretary of Goa, vide a communication dated 14.03.2005 addressed to the Secretary, MoWR, Govt. of India, informed that Goa was ready for a negotiated settlement without, however, withdrawing its request for appointment of a Tribunal made in July 2002. The readiness for negotiations was on the understanding that MoWR should not accord any sanctions or clearances to any project proposals of Karnataka, including those involving outside the basin diversion of Mandovi River Valley waters till all the outstanding River Water Disputes are finally resolved.

It is stated that the Chief Secretary of Goa vide his letter dated 08.08.2005 to the MoWR, Govt. of India, stated that Goa was firmly opposed to any consideration of Karnataka's Kalsa, Haltar & Bhandura Nala projects and refused to participate in the

proposed meeting on 9.8.2005 and he reiterated that Goa Government had sent its complaint requesting for appointment of Tribunal in July 2002, under the ISWD Act of 1956 and that this complaint was pending with the Union of

India for over three years for no justifiable reason. The only course left to resolve this Inter-State dispute was to refer the matter for adjudication.

(ci)

Various communications are stated to have been addressed by Goa to Govt. India, Prime Minister in this regard. The mention has been made of a number of meetings at various levels.

It is pleaded that in the inter-State meeting called by the Union Minister for Water Resources on 4.4.2006, the Chief Minister of Goa stated that Goa had tried negotiated settlement in the past on the clear understanding that in the meantime, Ministry of Water Resources, Planning Commission or Central Water Commission will not give any clearance to projects of Karnataka in Mandovi basin, whether or not involving outside the basin transfer and that Mandovi basin is a deficit basin and Malaprabha basin is a surplus basin and, therefore, it would not be appropriate to transfer water from deficit basin to surplus basin. It is

mentioned that he reiterated the request for constitution of the Tribunal under the ISWD Act, 1956, at the earliest. It is

claimed that in the above meeting the Union Minister suggested that the Chairman, CWC will convene a meeting of administrative and technical officers of the States of Karnataka and Goa, within 15 days, to sort out the issues in this regard, and report the outcome of the meeting to MoWR, but the Chief Minister of Goa did not agree to this and it was then decided that if the two states did not discuss and come forward with a negotiated settlement within 15 days (i.e. by 19.4.2006), the union Minister would initiate steps for appointment of a Tribunal.

It is claimed that thereafter, repeated requests appear to have been made by the Chief Minister of Goa and its various Officers, for that purpose, in the year 2006.

(cii)

It is averred that after October, 2006 several Newspaper reports appeared that Karnataka intends to proceed ahead with the construction of the disputed projects from October 2006, even if the same are not cleared by concerned agencies of the Union of India.

It is averred that Goa

genuinely apprehended that if Kar nataka’s disputed

projects are executed, and a part of the waters of Mandovi

River and its tributaries are diverted outside the basin, it would have disastrous consequences, thereby affecting the drinking water needs, the navigation and fishing activities, harbour, irrigation needs, domestic and industrial water supply facilities, salinity control in coastal region and irreversible environmental damages to Goa State. It is mentioned that Goa apprehended that Karnataka may even complete the disputed projects within a year and the announcements which appeared in newspapers, indicated that Karnataka would commence in October 2006 the construction of these disputed projects.

(ciii)

It is asserted that the Goa State had been pressing for an immediate constitution of the Mandovi River Water Disputes Tribunal, under the ISWD Act of 1956 and to refer its complaint dated 09.07.2002 without any further delay because Goa was apprehensive that MoWR or its Agencies or other concerned Ministries of Govt. of India and Agencies or the Planning Commission, may withdraw the order of

“withholding in abeyance” of the clearances granted earlier to State of Karnataka.

227

It is asserted that Karnataka's attempt was to make such outside diversion a "fait accompli" before a fair, adequate and through investigation was made and a just and final decision was rendered by a duly constituted Tribunal.

(civ)

It is mentioned that similar to construction of diversion channels on Kalsa-Haltar nallahs, started by the Karnataka State, the State of Maharashtra has also started work of construction of an earthen dam on Virdi nallah which is sub-tributary of Valvanti nadi, the latter being a tributary of the interstate Mahadayi river and this work is being undertaken, by the Maharashtra State, without securing clearance of competent authorities and despite objections from the State of Goa, voiced in the D.O. Letter dated 10-1-2008, addressed by the Chief Secretary Goa, to his counterpart in Maharashtra, to give instructions to stop forthwith the work, until the disputes regarding allocation of waters are resolved by the Tribunal, setup by the

Government of India, however, the work remains in full swing.

228

(cv)

It is mentioned that the Chief Engineer (WR), Goa addressed a communication 28.12.2007, to his counterpart in Maharashtra, requesting Maharashtra not to go ahead with construction and regulation of projects upstream in Madei Basin, as it may affect Goa's e quitable share but no communication has been received from CE, WRD, Mumbai, to the queries raised by State of Goa.

(cvi)

It is pleaded that on 22.4.2008 a meeting, between Secretary (WR), Goa and Secretary (WR), Maharashtra, took place at Goa wherein the concern of State of Goa with regards to Virdi Project was the main agenda and in the said meeting it was decided to conduct a site visit by Chief Engineers of both the States during the first week of May, 2008.

What is averred is that on 08.05.08 Chief Engineers of both the States, Goa and Maharashtra, visited Virdi Dam site and the catchment area of Haltar Nallah in Maharashtra

and in the discussions during the site visit Chief Engineer (WR), Maharashtra, disclosed that they were working out a flood storage dam at R.L 97.41 mts., from which about 15Mcum water could be diverted to Anjunem dam by

constructing a tunnel. It is mentioned that Maharashtra agreed to make available the details to Goa, once the project report was ready, but different alignments in consideration for the proposed flood storage dam were seen during the visit.

(cvii)

According to State of Goa, Konkan Irrigation Development Corporation, Government of Maharashtra, on 25.03.2011 made available brief salient features of the proposed flood storage Dam for Govt. of Goa on Haltar Nallah and the said proposal was carefully studied by WRD Goa for its implications and feasibility of the proposal and it was felt that the proposed Dam proposal may not be feasible to be implemented as the dam axis is located in protected reserve forest, and clearance for the same may not be forthcoming from Ministry of Environment and Forests.

It is stated that in the month of May, 2012, a Section of the local press reported that State of Maharashtra was planning to increase the height of the Virdi dam which was

under construction in Katika Nallah by 10mtrs with a plan to supply water from the storage thereof, to some areas

outside the Mahadayi River Basin and, therefore, the officers of WRD, Goa visited Virdi on the same day, but could not contact any project officials. It is averred that Goa addressed some communications to the concerned Maharashtra officers but failed to get any response. It is stated that the Chief Minister of Goa also sent a communication to the Chief Minister of Maharashtra to issue necessary instructions to the concerned department in this regard.

(cviii)

According to Goa, State of Maharashtra has deviated from their original proposal of constructing the Virdi Minor Irrigation Project at the original location in Haltar Nallah, for which the State of Goa had initially agreed to consider to consent with some conditions and the changed proposal was not consented by State of Goa for obvious reasons of likelihood of the project affecting the post monsoon flow in River Valvanti in Goa, where State of Goa has two major

water supply schemes, and many lift irrigation schemes. It is pleaded that moreover, the State of Maharashtra has till date ignored and failed to communicate the details of their latest proposal, or to deny existence of the same and State

of Goa is in total disagreement to the State of Maharashtra taking up the Virdi Project, without consent of Goa, and without proper Ecological Impact Assessment, in as much as the project is planned on a tributary of the interstate River Mahadayi, and is totally against the diversion of water outside the basin by raising the height of the dam.

(cix)

The State of Goa maintains that as all its efforts on its part in containing the State of Karnataka in the matter of altering the profile of Mahadayi River/River basin, and attempting to divert the waters from out of the basin failed, it was constrained to file Original Suit No. 4/2006 before the Hon'ble Supreme Court of India, invoking Article 131 of the Constitution of India, seeking, inter alia, for a mandatory direction against the Union of India to immediately constitute a Mandovi River Water Disputes Tribunal under the Inter-state River Water Disputes Act, 1956, and direct State of Karnataka not to proceed with any planning, construction and water regulation of any projects in the

Mandovi River basin, until all the interstate disputes were adjudicated and decided by the Tribunal to be constituted

by the Central Government. This Suit was instituted on 15.09.2006.

(cx)

It is mentioned that in that Suit before the Supreme Court the State of Karnataka on 27/9/2006 94 filed an Interlocutory Application befor e the Hon'ble Supreme Court of India stating that it (The State of Karnataka) proposes to divert waters to the extent of 7.56 tmc annually and supplementary Affidavit was also filed.

(cxi)

It is pleaded that the Ministry of Environment & Forests, Union of India addressed a communication dated 16.10.2006, to the Chief Minister, State of Karnataka, stating that the Project on Kalsa – Bhandura Nallah Project required environmental, as well as forest clearances, and therefore, such Project may not be taken without obtaining necessary statutory clearances. It is informed that Shri K. Vora, Senior Joint Commissioner, Ministry of Water Resources, Union of India also addressed communication to

the State of Karnataka, stating that the request from the State of Goa for constituting Water Disputes Tribunal was under consideration, and that any executive action on the

part of the State of Karnataka, in relation to Mahadayi should not come in the way of settlement of the disputes which had arisen.

(cxii)

It is averred that in the Suit proceedings before the Supreme Court, the State of Goa filed Rejoinder dated 10.11.2006 and additional Affidavit dated 15.11.2006, opposing the reliefs prayed for in the Interlocutory Application made by and on behalf of the State of Karnataka and the Union of India, Ministry of Water Resources also filed a Counter Affidavit dated 20.11.2006, clarifying that the Union of India has not withdrawn the abeyance letter dated 19.9.2002, nor does it have any intention to do so, till the water disputes relating to Mahadayi are either amicably settled amongst the party States, or adjudicated by the Competent Tribunal.

It is pleaded that the State of Maharashtra filed its affidavit dated 14.2.2007, stating that it does not take any contentious attitude in disputes between Goa and

Karnataka in respect of relief, but, Maharashtra disputed contention of Goa that project within a State cannot be

considered or proceeded without approval of Central Government and it stated that in the event of disputes about utilization of waters between States of an Inter-State river, appropriate machinery is defined under Article 262 of Constitution, read with Section 4 of Inter-State Water Disputes Act, 1956.

(cxiii) According to the State of Goa, the Deputy Commissioner(BM), MoWR, Govt. of India, filed an affidavit dated 13.2.2008, in compliance to the directions of the Supreme Court, making the following statements:



The Ministry of Environment & Forests, Govt. of India, takes the stand that prior approval must be obtained from it before carrying out any non – forestry activity on Forest Land. Prior approval of Supreme Court and the National Board for Wild Life is essential before taking up any activities in National Park/Sanctuary. If a project involves forest as well as non-forest land, work should not be started on the non-forest land till approval of Govt. of India, has been obtained for release of forest land.

235

The stand that a State Government can take up a project in an interstate river basin with its own funds without waiting for clearance from the Planning Commission is against the spirit of the Planning Commission's Guidelines dated 3 0.11.2000 for according investment clearance.

The affidavit further states that the spirit of the guidelines is that interstate water use cannot be changed without approval irrespective of whether Plan or non-Plan resources are used.

(cxiv)

It is averred that on 21.04.2008, State of Karnataka filed Reply Affidavit in response to Union of India's Affidavit of

13.02.2008, and contested the views of the Union of India in respect of the Forest Conservation Act, 1980, and Para 4.4 of the Guidelines and Clarifications and also stated that the Kalsa-Bhandura projects do not fall under any of the National Parks of Sanctuaries and therefore no permission is required to be taken.

(cxv)

It is mentioned that on 30.04.2008, the Hon'ble Supreme Court passed orders restraining Karnataka from utilizing, or

diverting, the waters under the Kalsa-Bhandura projects till the next date of hearing and the order further directed Union of India and Maharashtra to file their written statements and also, Goa to submit its reply statements. It is pleaded that the State of Goa has given the details of proceedings before the Supreme Court and matter was taken up for various proceedings on different dates, but on 27.08.2008, Supreme Court while adjourning the matter till 14.10.2008 directed that the interim order dated 30.04.2008, restraining Karnataka from utilizing waters under the Kalsa Bhandura projects would continue.

(cxvi)

According to State of Goa, on 09.01.2009, The Government of Goa filed Interlocutory Application, with a prayer to (a) Direct Government of Karnataka to stop the construction activities at the project site, (b) Not to proceed with any planning & construction and water regulation of any project in the Mandovi river basins until the Union of India constitutes the tribunal, (c) Direct the Union of India to

immediately constitute the Mandovi River water dispute tribunal.

(cxvii)

It is informed that on 10.12.2009, Union Cabinet approved the Constitution of Mahadayi Water Dispute Tribunal(MWDT) consisting of a Chairman, two members and two Assessors for adjudication, to adjudicate the River Water Dispute between the States of Goa, Karnataka & Maharashtra in respect of sharing waters of Mahadayi (Mandovi) River, and accordingly, when on 18.01.2010 the Original Suit was re-listed for arguments before Supreme Court, the Government advocate representing Union of India made a statement that Union cabinet had decided to constitute the Madei River Water Disputes Tribunal.

It is mentioned that on 22.11.2010, the Government advocate representing the Union of India placed a copy of

the Notification dated 16-11-2010 issued by the Central Government, constituting a Tribunal to decide the water disputes relating to the Mahadayi River and River Valley and he also stated that a separate Notification was also being issued referring the entire disputes to the same Tribunal.

It is informed that on 20-1-2011, the Additional Solicitor General representing the Union of India placed a copy of the Reference Notification dated 11th January 2011

before the Apex Court and on this date, the Original Suit No. 4/2006 came to be disposed of.

(cxviii)

The State of Goa has pleaded that both the States of Karnataka and Maharashtra, have not divulged information about their planning of projects in the Mahadayi Basin Area, although it is clear that the plans are afoot to alter the profile of Mahadayi River, and to divert its water from its basin, the precise extent and methodology were relatively unclear and, therefore, in the circumstances, it would be just, fit and proper that appropriate directions be issued by this Tribunal to the State of Karnataka and State of Maharashtra, to place on record the details with regard to the proposed Projects and thereafter liberty be granted to the State of Goa to make additional submissions in that regard.

It is further submitted that with regard to some of the Projects, the State of Karnataka has illegally proceeded with the w orks and the entire attempt appears to create a ‘fait

accompli', and an attempt is being made to justify

diversions, citing alleged need of Hubli – Dharwad drinking

water requirements. It is vehemently pleaded that this action of Karnataka is totally incorrect, inasmuch as the entire attempt is to divert waters for irrigation purposes. It is asserted that the water available in the Malaprabha basin is being mismanaged and mis-utilized and in fact, the entire attempt is to put into jeopardy the very sustenance of Mahadayi River and the Mahadayi river basin, the large part of which is located in the State of Goa.

(cxix)

According to the State of Goa, the Malaprabha Reservoir Project at Naviluteertha in Belgaum district of Karnataka was completed in 1974 to irrigate an area of 2,18,000 hectare in Dharwad, Belgaum and Bijapur Districts and what was envisaged during the planning of the project as the “cropping pattern” and what exists today are in complete contrast. It is mentioned that crops like paddy, sugarcane and horticulture, which are water guzzlers seem to have replaced the traditional cropping pattern and in the last thirty years several sugar mills have come up in the

Malaprabha basin, apart from many others in neighbouring areas. It is stated that the traditional four-month cultivation cycle has found it difficult to resist the profit-driven

approach of growing of the 11 month water intensive crops and the farmers at the head and mid reaches of the irrigated belt are using water of the east-flowing Malaprabha by employing electric pumps.

(cxx)

It is submitted by Goa that the Malaprabha Reservoir Project at Naviluteertha in Belgaum District of Karnataka was completed in the year 1973 to irrigate an area of around 2,18,000 hectors in Dharwad, Belgaum and Bijapur Districts and as per the statistics made available by the State of Karnataka, at the time of planning of the reservoir, the 75% dependable yield was computed as 44 tmc and accordingly the reservoir was constructed with a live storage capacity of 34.346 tmc, but as per the State of Karnataka, the 75% dependable yield has come down from 44 tmc to 26.649 tmc, and after its construction in 1973, the reservoir has filled only on 6 occasions. It is informed that a few years immediately after the construction of reservoir, say about 10 years, should have been sufficient for the

State of Karnataka to realize that the actual yield is less than their expected yield and the State of Karnataka should have enforced demand side management and ought to

have controlled water utilization, giving highest priority to drinking water requirements of Hubli-Dharwad cities, but instead, crops such as sugarcane and paddy have been promoted and allowed to replace the traditional crops along the Malaprabha basin. It is vehemently asserted that the water distribution infrastructure in Hubli-Dharwad is old resulting in wastage of water.

(cxxi)

It is pleaded that the Kalsa Bandura project is being executed by the State of Karnataka in the most illegal, brazen and unauthorized manner without required permissions, licenses etc., and also without adequate design, structure and hydrological planning. It is submitted that the observed stream flow data are not available at the Haltara and Kalsa Dam sites and the yield at the said two sites have been assessed by using Inglis Formula, which is an empirical, outdated and unrealistic formula.

(cxxii)

It is stated that the State of Karnataka is going with the

Kalsa Bandura Project without assessing the likely impact of the reduction in flows caused by the construction of Haltara Dam, Kalsa Dam, Inter-connecting canal connecting Haltara

Reservoir with Kalsa Reservoir and Interconnecting canal connecting Kalsa Reservoir to Malaprabha River on the River Mhadei, on its Flora, Fauna, wildlife and other environmental factors, like salinity, navigation, agriculture, industries, fisheries etc. It is pleaded that the proposed diversion of 7.56 tmc of water from Mhadei to Malaprabha basin would considerably reduce the flow of water of the River Mhadei and its Tributaries/Nalas. It is stated that the proposed site of Bandura dam is located very close to the Bhimgad Wildlife Sanctuary, and in any case, it is within the buffer zone. It is submitted that any construction activity would definitely affect the flora and fauna in that area.

(cxxiii)

The State of Goa states that Bhimgad Wildlife Sanctuary in Belgaum District, Khanapur Taluka, Sharavathy-Khanapur Corridor is declared as a Wildlife Sanctuary vide an Order dated 28.11.2011 and this Wildlife Sanctuary is adjacent to Mahadayi Wildlife Sanctuary and Bhagwan Mahavir Wildlife Sanctuary. According to State of Goa, Bhimgad Wildlife

Sanctuary is contiguous to the Mahavir Wildlife Sanctuary,

Netravali

Wildlife

Sanctuary

and

Khotigao

Wildlife

Sanctuary and it is an important corridor for Tigers.

(cxxiv)

It is further stated that the Eastern boundary of the Bhimgad Wildlife Sanctuary runs through the left Bank of Mahadayi River, and the boundaries of Jamgao and Abnali Villages, whereas the Southern boundary of the Bhimgad Wildlife Sanctuary runs through Mendir forest through the South-East side of Goa and the Western boundary runs through Bhagwan Mahavir and Mahadei Wildlife Sanctuaries in Goa ending at Village Chikale. It is mentioned that the Northern boundary runs along the Bail Nadi in the Northern side joining the Mahadei River as the boundary ends at Kongla-Kabals footpath.

(cxxv)

The State of Goa states that the region is home to Tigers,

Leopards, Gaur, Chital, Sloth Bear, critically endangered bats and scores of other species and that the Bhimgad Wild Life Sanctuary and its reserve forests are spread across 191 Square Kilometers in Khanapur Taluka, in Belgaum District of Northern Karnataka. According to the State of Goa, it is perhaps the only forested Taluka of Belgaum District which is connected to its South with Uttar Kannada, Karnataka's District with the densest of maximum forest cover. It is informed that this habitat is contiguous with the Anshi

National Park, Dandeli Wildlife Sanctuary, Bhagwan Mahavir National Wildlife Sanctuary, Mhadei Wildlife Sanctuary and Netravali Wildlife Sanctuary and the Tiger corridor of Sindhudurg District, Maharashtra, and is part of a crucial biodiversity vault of the threatened Western Ghats. It is stated that this entire region is sustained and supported by the Haltar nallah, the Kalsa Bhandura nallah and their tributaries, along with the Mahadei River and its tributaries. (cxxvi)

According to State of Goa, Dandeli Wildlife Sanctuary and Anshi NP to the South of Bhimgad Wildlife Sanctuary are Tiger reserves since 2006. The State of Goa states that that there is evidence to show that Tigers in Goa are not merely transient animals, but are a resident population and the forests around Chorla, Mann and Kankumbi comprise a contiguous Tiger Landscape corridor to Bhimgad Wildlife Sanctuary in Karnataka to its South-East and to Anshi Dandeli Tiger Reserve to its South which has around 35 Tigers.

(cxxvii)

It is pleaded that in a study carried out in 2008, the Wildlife Institute of India (WII), had pointed out that the Protected

Areas (PAs) of Goa and their contiguous forests in Karnataka and Maharashtra are possibly some of the best potential tiger habitats in the Western Ghats region and they are in need of protection.

(cxxviii)

What is averred is that the forests that will be affected due to diversion of waters by the Haltara Nallah diversion and the Kalasa Bhandura Nallah diversion are a confirmed King Cobra habitat, with densities comparable to other Western Ghats habitats. The State of Goa States that the water network of these forests support densities of this snake which is the world's largest veno mous snake. It is mentioned that the King Cobra is also considered as one of the flagship species of rainforests in the world, and any scarcity of water will impact these fragile eco systems and their denizens.

(cxxix)

The State of Goa states that it is a niche habitat to lesser-known endemic mammals of the Western Ghats of India

including the brown civet and the small Indian Travancore flying squirrel and these waters of the Haltara nallah and the Surla River sustain multi canopy forests that are crucial

to the survival of these charismatic and yet hitherto lesser-known mammals of the Western Ghats.

(cxxx)

According to State of Goa, researchers from the Mahadei Research Center have recently discovered the Mhadei caecilian, a new species of amphibian to the world of science in this habitat, and amphibian researchers strongly believe that many more species await discovery in these wet evergreen and mixed moist deciduous forests and efforts to conserve these areas will be a boon to science.

(cxxxi)

It is informed that the cave formations and intrinsic forest cover of ecosystems forests support two of the rarest and endemic aspects of Bats in the world, namely the Wroughton's free tailed Bats (*Otomopswroughtoni*)which is classified under 'Schedule 1' under the Wildlife Protection Act and is classified as 'data deficient' with population trends unknown. It is pleaded that the other species, Theobald's Tomb Bats (*'Taphozustheobaldi')* is'data

deficient’ and very little is k nown about its breeding biology and conservation status and researchers with the Mhadei Research Center believe that these forests are the hunting

grounds of these Bats and studies are ongoing in this regard.

(cxxxii)

The State of Goa maintains that the flora of the region is highly diverse and includes riverine and plateau vegetation besides high tree canopy forests and myristica swamps and other unique flora in Mhadei and in Bhimgad forests depend on water. It is averred that being part of the Western Ghats landscape, these areas are among the 200 Top Priority Global Eco regions of the World, as identified by WWF International whereas remnants of primeval natural forests that have remained relatively undisturbed and big enough to maintain their biological diversity and composition exists in the region that will be affected by the diversion.

(cxxxiii)

According to State of Goa, the Region is extremely rich in avian fauna and is supported by the presence of fruiting trees and an array of insect diversity, and various

ornithologists have catalogued an estimated 220 plus species in the Bhimgad region. It is mentioned that the Great Pied Hornbill, the Imperial Pigeon and the Ceylon Frogmouth are some of them. The State of Goa states that

any attempts at abstraction of water will mean irreversible alteration and eventual destruction of habitat which will destroy crucial habitat of these Avian diversity. It is emphasized that continuous efforts along with local birdwatchers and the researchers of Mhadei Research Centre have helped in declaring a part of this region (Mhadei Wildlife Sanctuary in Goa and Bhimgad Wildlife Sanctuary) as an Important Bird Area by Birdlife International and the Indian Bird Conservation Network. (cxxxiv)

What is stressed is that the fresh water fish diversity of the Region is yet to be catalogued completely and the intrinsic crisscross network of streams, rivulets and nallahs are considered home to many endangered and endemic species of fresh water fishes of the Western Ghats of India. Being part of the Western Ghats of India, the region has been recognized by the World Conservation Monitoring Centre as one of the most important areas for fresh water biodiversity.

(cxxxv)

It is pointed out that the presence of dense and healthy forests with Mhadei Wildlife Sanctuary, Netravali Wildlife

Sanctuary, Bhagwan Mahavir Wildlife Sanctuary and Cotigao Wildlife Sanctuary of Goa, the reserved forests of Sindhudurg District and the Anshi and Dandeli Tiger Reserves make this area as one of the largest contiguous areas after the Nagarahole and Bandipur areas for large cats as well as for elephant movement and breeding.

(cxxxvi)

It is mentioned that the conservation of this area will also ensure protection to the catchment areas of important Rivers like the Mhadei, Malaprabha, Pandhari, Bailnadi, Tillari, etc. and will address the water security issues for the States of Goa, Karnataka and Maharashtra for the future, which areas are now already water deficit areas.

(cxxxvii)

It is stated that along with the Tiger reserve, the area will also secure an established corridor for elephants and will ensure safe passage to migratory herds, from of forests of Dandeli and Anshi and help address the issue of human elephant conflicts in Goa.

(cxxxviii)

With regard to the availability and need of water of the State of Karnataka, the State of Goa has submitted as under:

- even if the 75% dependable yield is 26.649 tmc, that is much more than the drinking water needs of the cities of Hubli – Dharwad, and as per the National Water Policy, the drinking water supply gets priority over all other needs;

- In the few years immediately following the completion of reservoir in 1973, the State of Karnataka would have observed that the reservoir is not filling and that the actual yield is less than the computed yield, and therefore they should have controlled the further use of water by controlling the cropping pattern; promotion of water saving techniques such a drip and sprinkler irrigation; conjunctive use of surface and

ground waters; Instead crops such as sugarcane and paddy, which are water guzzlers, have been promoted and allowed to replace the traditional cropping pattern. If they had done proper planning then the alleged water shortage would have been overcome.

Since the reservoir has been constructed with a much larger capacity, than the actual 75% dependable yield, it places the State of Karnataka in a position to use the 50% dependable yield, and therefore the figure of 26.649 tmc as the yield ceases to have significance;

The State of Goa has reiterated that such alleged drinking water shortage can very well be met by diverting the water from rivers Kali and Bedti (which are intra State rivers), rather than resorting to inter basin diversion from River Mhadei.

The State of Goa emphatically denies the contention raised by the State of Karnataka that further augmentation of supplies from Malaprabha basin from irrigation to drinking water would not be possible, as the farmers from the Malaprabha region are threatening to ‘blow up pipes’. It is emphasized that State of Karnataka has 12 rivers whose potential has not been fully tapped. It is further

submitted that the National Water Development Agency (NWDA), an organization under the Union Ministry of Water Resources has been entrusted with the task of investigating

possibilities of inter-basin water diversion and the NWDA has identified 16 possible links in peninsular India. What is asserted is that it is pertinent to note that for the Western Ghats in Goa-Karnataka region, the NWDA has not identified Mandovi – Malaprabha as a feasible link, and on the contrary the NWDA has identified Bedti – Varda as a feasible link, however, for reasons unknown, the State of Karnataka is insisting on diverting Mandovi water in to Malaprabha.

The State of Goa maintains that the stand of the State of Karnataka that Kali and Bedti rivers are water deficit basins or that the diversion from Kali and Bedti rivers is economically not feasible are incorrect and denied. According to the State of Goa, the NWDA has rather proposed diversion of water from Bedti to Varda, and this fact clearly establishes the fact that Bedti is in fact a water surplus basin.

37.

As noticed in the opening paragraphs of this Award,

an Order dated 03.09.2014 was passed by this Tribunal, with regard to a “Brief Note on Inconsistencies in Data/Information

related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case/Statement of Claims and Related Documents", which had been brought to the notice of the learned counsels representing the three States and in view of the consensus about some data/information in various documents being inconsistent and/or incomplete, the Tribunal had exercised its powers conferred on it by Sections 9(1) (ba), 9(2) and 9A of the Act, and had given directions to the three party States, as well as the Central Government, with a view to secure required material, data as well as carry out surveys and investigations and to produce relevant data before it to enable the Tribunal to

decide the two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stake holders, which have been highlighted in the “Brief Note”.

Accordingly, all the Party States carried out those directions of the Tribunal, and filed their respective further amended pleadings, within the time originally granted, or later extended, by the Tribunal.

The said amended pleadings, besides taking new pleas, also reiterated the original pleadings. At this stage it would also be relevant to notice, in extenso, the aforesaid amended pleadings of Goa.

While noticing the pleadings of Goa, in detail, as above, the Tribunal had made it clear that the pleadings of Goa were being noticed, as given in the Statement of Claim, original or amended, without offering any comments of this Tribunal, in any manner. Similarly, the Tribunal is also not offering any comments itself, while noticing the amended pleas of Goa, as below:

(i)

The State of Goa has referred to the response in para 5.108 of the Reply dated 27.03.2014, submitted by the State of Karnataka that the State of Karnataka has considered five alternatives for the purpose of meeting the alleged drinking water needs of Hubli Dharwad region, and that both Kali and Bedti diversions were highly uneconomical, because the capital cost involved in the case of Mhadei – Malaprabha link was Rs.372 Crores, whereas the capital

cost for Kali lift and Bedti lift were Rs. 464 Crores and Rs. 660 Crores, respectively. It was alleged therein by the State of Karnataka that the aforesaid lift schemes would also

involve huge power consumption and, therefore, in the circumstances, the State of Karnataka had sought to contend that diversion from Mhadei basin was the only alternative in order to meet the alleged water needs of the Malaprabha basin.

With reference to the above stated case of State of Karnataka, State of Goa states that the State of Karnataka does not possess any Pre-Feasibility Report (PFR), Feasibility Report (FR) or the Detailed Project Report (DPR), for diversion of water from Kali to east flowing rivers in the State of Karnataka, such as Malaprabha River.

According to the State of Goa the stand taken by the State of Karnataka is apparently false. It is submitted that without even preparing a PFR or FR (much less a DPR), for examining other alternatives for meeting the alleged water needs of Malaprabha basin, through the intra-state rivers in the State of Karnataka, such as Kali and Bedti, the State of Karnataka has wrongly stated that the Kali and Bedti diversions are not feasible, financially or otherwise. It is

asserted that it is inconceivable as to how the State of Karnataka could arrive at such conclusions, without even

preparing a PFR or FR pertaining to Kali or Bedti diversion proposals.

(ii)

Goa has maintained that the proposed Mahadayi River Valley scheme involves building six dams on the Mahadayi and its tributaries near Kankumbi-Chorla to divert water into the Malaprabha, while the Mahadayi hydroelectric project will have five more dams on the tributaries to produce Hydro-Electric power and the main diversion dam on the Mahadayi known as Kotni dam, is also designed to produce power, apart from diverting water into the Malaprabha above Khanapur.

(iii) It is asserted that these dams will be: one on Kalsa (above its confluence with Surla), one on Haltar Nalla, diverting its water into Kalsa reservoir near Chorla and three small dams on Potni Nalla above Kankumbi (it meets Tillari river in Maharashtra), interconnected and led into Kalsa reservoir. Kalsa reservoir, cumulatively then, is diverted to the Malaprabha through a tunnel near Kankumbi whereas the

water from the main Kotni dam is to be led through a 5.5 km tunnel into the Malaprabha at Asoga near Khanapur.

It is emphasized that these six diversion dams involve 1.6 km of dam length, 6.4 km of tunnels, through forested ridges, and 3.5 km of open channels as excavations, and areas of submersion amount to 4,300 acres of prime forests and 1000 acre of dry and wet agricultural land. It is stressed that the second project-Mahadayi Hydroelectric project with twin purpose Kotni dam and dams on the tributaries of Irti, Bail and Andhari will submerge another 400 acres of pristine forests bringing the total area of submergence to 5,700 acres including the few villages. It is emphasized that the diversion dam on Kalasa (above its confluence with Surla River) will be depleting the waters of Surla River, which makes a beautiful waterfall in the Chorla Ghat and this will turn into a mere trickle like the Jog falls. It is stated that besides, the reduction in waters of Surla River, it will also alter the ecology of Sattari Taluka of Goa State, affecting its agriculture, fishery and its economy.

(iv) It is submitted that Opa water works is the first water treatment plant of Goa and its operation started during

Portuguese regime in 1957, and is situated at Opa, Khandepar of Ponda taluka in North Goa District, and is

about 37 Kms from Capital city Panaji. It is pleaded that major treatment plants along with the clear water reservoirs of Opa water works are located at hillock of Curti, which is at 160 RL (“ Reduced Level ”) and the drinking water needs of the Talukas of Ponda and Tiswadi, which include major city of Panjim and Ponda, are supplied from the Khandepar River, through a water treatment plant at Opa on the banks of Khandepar River, which is a tributary of Mandovi River. It is pleaded that as at present, demand of potable water is more than 140 MLD (“ Million Liters per Day ”), more than 4.50 lakhs o f population have been covered under Opa water system. It is emphasized that the demand is increasing day by day with the rise in urban population, increase in industrialization, tourism etc., and it has been observed that the dry weather base flow in the Khandepar River especially during the lean months of February to May is not sufficient to meet the above said drinking water requirements.

It is stressed that the Khandepar sub-basin of the

Mandovi Basin is critically dependent on the availability of water in the Mhadei River. It is, therefore, maintained that

the diversion of water outside the basin by the State of Karnataka would further aggravate the drinking water shortage at Opa water works. It is stated that the treatment process slows down in the monsoon due to high turbidity, and the depletion of raw water due to the proposed diversion of monsoon waters and impoundage of inflow throughout the year by State of Karnataka, at upstream through their various contemplated projects, will further aggravate the situation and may render loss of efficiency of pumps especially when during dry season at present, the State of Goa is compelled to curtail the water for irrigation requirements to meet the drinking water needs as the summer approaches.

It is stated that even to meet the minimum drinking water needs of areas served from Opa, the Water Resources Department has had to undertake measures to augment the River Khandepar which include besides several other measures for transfer of water by pumping from the main Mhadei River at Ganjim to Opa.

(v)

Goa maintains that as at present, Opa water works consists of four water treatment plants which are having a cumulative water treatment capacity of 115 MLD, but as on today Opa water works treats almost 140 MLD (average) of raw water to cater the increasing demand of growing population in the service area, and keeping in mind the ever-rising demand of potable water, it is planned to set up additional 27 MLD water treatment plant at Opa, and construction of another 25 MLD Water Treatment Plant on Mhadei river at Ganjem to supply potable water to villages Pali, Cottombi, Surla, Velgaum of Bicholim Taluka, Vantem and Guleli of Sattari taluka Pillem and Dharbandora of Dharbandaro taluka, Usgao, Ganjem, Vagurme, Savoi-Verem, Volvoi and Kerim in Ponda taluka. It is stated that these projects are designed to cover the need of projected population of 2031 AD with per capita coverage of 135 LPCD (“ Liters per Capita per Day ”) and for all these projects, the proposed and only available raw water source being

Mhadei River, any diversion or impoundage of waters at the U/s region by Karnataka will jeopardize these projec ts' prospects and there is no alternative water source available for Goa to compensate the same.

261

(vi) It is asserted that the Kalasa-Bhandura water diversion scheme on which the work has already commenced is going to submerge about 723 Ha (Kalasa 320 Ha & Bhandura 403 Ha).

Should Karnataka go ahead with the Kotni Hydroelectric & diversion project on the scale that it has been planned, the total area to be submerged will be 2145 Ha forests plus another 330 Ha of forest land for roads, dams power houses, township, field offices, etc., and the villages that will be submerged, some them completely and some partially are: Kankumbi, Parwad, Chorla, Kongla, Kirwale and Kabnail, Gavali, Pastoli, Nerse, Jamgaon, Mugwede, Chapoli, Jamgaon and Kavale.

(vii) Goa has pleaded that as at present the salt water ingress and the tidal influence is felt 36 km upstream beyond Ganjem or nearly 70% of the river's length in Goa and reduction in the fresh water flow from Karnataka would completely alter the river profile by moving the estuarine front deeper even beyond Valpoi.

(viii) It is stated that out of the total drainage area of 1,580 sq.km. 509 sq.Km. is affected by salinity, and in another

540 sq.km. local conditions do not permit any water resource conservation schemes, and that leaves only 531 sq km drainage in Goa which could be utilized. It is mentioned that the increase in the salinity level will have a detrimental effect on Goa's entire coastal ecosystem, not only jeopardizing Goa's Khazan lands, mangroves, avifauna, agriculture, fisheries and river navigation, but also its drinking water storages, and treatment plants at Sanquelim, Opa and other places, sharply reducing the drinking water availability in the river basin.

(ix) It is pleaded that the Mandovi estuary is navigable round the year up to about 35 km from the mouth upstream and is one of the two main waterways of Goa mainly used for transporting iron ore barges of capacity 1,000-1,500 tons and transported to the Marmugao Port for export. It is stated that the depth of estuary varies from 8-10 m at the mouth to less than 2 m.

(x)

According to State of Goa, it has objected that the attempt

of Karnataka to use the pretext of Hubli- Dharwad towns' pressing drinking water needs as the alleged justification for

outside basin diversion from the water short Mandovi river basin, is without basis, and the disputed Kalsa Bhandari Nalla projects are commenced without waiting for sanctions from the Central Government, and the resolution of the disputes from Inter-State river aspects. It is stated that Karnataka having given up for now the proposed transfer of diverting Mandovi river water into the Kalinadi basin for hydropower generation, and then to Malaprabha sub basin for increasing irrigation, is now giving a new scheme for diversion outside the basin, and has conveniently changed the project into drinking water project to meet the so called alleged needs of Hubli-Dharwad, and Karnataka has never come up with any particulars of the population of Hubli – Dharwad with full materials, and evidence and the gross genuine drinking needs for this population on national standards of per capita supply per day for urban population. It is averred that the existing sources of water supply and the extent of the real shortage if any have not been disclosed, and Karnataka has not mentioned as to how the

domestic water supply needs of Hubli – Dharwad cannot be met locally from waters available in the surplus Malaprabha

Sub basin, in which these two towns are located or from Kalinadi basin just adjoining these cities.

(xi) The State of Goa maintains that according to 2001 census, the population of the twin city Hubli – Dharwad is only 7,86,195, and considering a liberal daily supply rate of 200 liters per capita per day which is higher than prescribed quantum, the aggregate annual domestic water supply needs of this town city would be only 2 tmc (57.40 Mcum) and not 7.56 tmc as alleged by it. It is emphasized that a major part of the need is already met from the existing supply, and NWDA (National Water Development Authority) has already assessed Malaprabha as a water surplus sub basin even after taking into account and allowing for the long-term development of increased irrigation and

increases in population (up to 2025 AD) and domestic water supply which includes Hubli – Dharwad. It is pointed out that the plea of Karnataka as to the alleged shortages and the proposed diversion that too trans basin would affect the lower riparian state of Goa, when the river is the only natural resource for all its irrigation, drinking, environmental and ecological needs, flora and fauna for the

State of Goa and in contrast Karnataka has the benefit of several rivers. It is pointed out that the entire attempt is to somehow to proceed with its unilateral action to commence and complete the diversion project and thereby make a fait accompli situation.

It is further submitted that the persistent and repeated attempts by Karnataka to divert the Mandovi river waters to outside the basin are being made to deplete and evacuate a part of this scarce resource from its natural course, to Malaprabha sub basin only to increase the sugar cane cultivation area in Malaprabha sub basin in Karnataka.

(xii) The State of Goa has pleaded that the neighbouring State of Karnataka is having 7 river systems, having a total drainage area of 190.5 thousand Sq Km. Out of these seven river systems, the main river systems viz. Godavari, Krishna. Kaveri are forming nearly 80% of the area of Karnataka, whereas the west flowing rivers (which includes Mahadayi, one of the Inter-State rivers) are covering 24000 Sq.Km., which forms nearly 13% of the total geographical area, and

the Mahadayi River which is having a total drainage area of

2032 Sq. Kms, covers 375 Sq.Km., in Karnataka, which is only 0.2% of their total geographical area of Karnataka State, which shows that unlike Goa, Karnataka is rich in Water Resources not withstanding any diversions from Mahadayi River. It is asserted that State of Goa has only two main rivers Mandovi (Mahadayi) and Zuari, which are covering nearly 70% of the total geographical area of the State of Goa.

It is pleaded that similarly, State of Maharashtra has 5 river systems

out of which 4 river systems namely

Godavari, Tapi, Narmada and Krishna which are east flowing rivers, which cover nearly 89% of the total geographical drainage area of the State, whereas the west flowing rivers are covering nearly 11% of the geographical drainage area out of which interstate Mahadayi river covers 77 sq.km basin area in the State of Maharashtra and is hardly 0.025% of the total state geographical area.

It is thus maintained by Goa that the water resources

available of the interstate rivers draining out to State of Goa, as a lower riparian State, is very negligible, whereas

for State of Goa the said rivers are the lifeline covering nearly 70% of the total State's geographical area. The Goa pleads that any plans to divert the said waters will not be practicable, as the same will cause irreparable damages to the water security of the State of Goa.

(xiii) The State of Goa has pleaded that issues nos. 12, 13, 14, 15, 18, 19, 22, 24, 25, 26, 27, 28, 29, 30, 34 and 42, as framed by the Tribunal, pertain to true assessment of water availability and budgeting in River Basins adjoining the Mhadei River Basin, for the purpose of arriving at just and correct adjudication of the present dispute.

Goa has stated that since the Krishna Water Dispute Tribunal has already examined and adjudicated upon the water availability, protected usage and water sharing formula of the Krishna River Basin, the State of Goa has inspected the documents and pleadings pertaining to the Krishna Water Disputes Tribunal at New Delhi and Bengaluru, and accordingly, the State of Goa proposes to rely upon those pleadings/documents in support of its case;

but for the limited purpose of confronting the case put up by the State of Karnataka.

(xiv) However, the State of Goa maintains that it, in any manner, does not admit the correctness of contents of the said documents, in so far as they are inconsistent with or contrary to the case set-up by it, but reliance shall be placed on those documents/pleadings only for the limited purpose of pointing out the contradictions in the case of the State of Karnataka, as pleaded before this Tribunal, and to confront/cross examine, wherever necessary, any such evidence produced by the state of Karnataka. The State of Goa has given the details of some documents which it would produce, for the limited purpose of confronting the case of the state of Karnataka, and that too without in any manner, whatsoever, admitting the said documents. Besides that, Goa, also has reserved its right, to produce other documents and the pleadings of Karnataka from Krishna Water Disputes Tribunal.

(xv) It is submitted that the Government of Karnataka is merely

using the pretext of drinking water needs to Hubli and

Dharwad as a bogey for diversion of waters from the Mahadayi basin and alteration of profile of Mahadayi River, because in reality, the purpose is to utilize the waters from the Malaprabha basin entirely and excessively for irrigation purposes, particularly for catch rich crops like sugar cane. It is stated that further, the Government of Karnataka is mismanaging their existing water resources and thereafter lay claims of water resources upon which other States are heavily dependent.

(xvi) The state of Goa submits that the area under sugarcane cultivation, and the sugar production in the Malaprabha basin from the years 1972 – 2013 has drastically increased, and for instance, it is emphasized that the area under sugarcane cultivation in the said basin for the year 1979-80 was 224 hectares, but it has risen to 2756 hectares in the year 2012-13, which is an increase by more than 12 times. Also, it is stated that the State of Karnataka has not stopped issuing permissions even for the setting up of new sugar factories in the said region, thereby promoting

cultivation of water guzzling crops, such as sugarcane, in the

said region, despite the alleged water scarcity in the Malaprabha basin and particularly in the Hubli-Dharwad region. It is mentioned that the State of Karnataka has not taken any steps to further control the use of water for irrigation and particularly for water-guzzling crops such as paddy and sugarcane.

(xvii) The State of Goa has pleaded that the ground water levels in the Hubli Dharwad region have been supplied by the State of Karnataka, in reply to interrogatories raised by the State of Goa vide their Annexures 8(A) to 8(F), which indicates that there is an abundance of ground water resources available in the region.

State of Goa submits that in the month of May when the ground water levels hit the lowest, the ground water table in Hubli in the year 2013 was 38.55 meters, which is much better than the ground water level post monsoon in many parts of the country. State of Goa has further submitted that the ground water table during the month of May in the year 2001 was 9.92 mts. indicating an abundant

supply of ground water level waiting to be exploited.

Thus, it is stated that the ground water level in the Malaprabha basin is quite good and there is lots of potential to exploit the said ground water resources available in the said region.

(xviii) According to the state of Goa, the state of Karnataka has not carried out any study relating to water distribution system for assessing the loss of water in the water distribution system of Hubli Dharwad cities, nor the State of Karnataka has assessed, if the alleged drinking water shortage can be met by reducing such losses.

(xix) On the basis of the aforesaid pleas, according to Goa, it is apparent that there is abundant supply of ground water resources for meeting the alleged water shortage of the Hubli Dharwad region, whether for drinking or irrigation, or any other purpose and there is scope for saving water by reducing the area under water guzzling crops like paddy and sugarcane; and there is also the scope for saving water by modernizing the water distribution system. Goa maintains

that by not doing so, the State of Karnataka is grossly mismanaging its available water resources within the

Malaprabha basin, and it vehemently states that, there is no reason, whatsoever, for diverting the water from the Mhadei basin at the cost of causing irreparable prejudice, damage and harm to the State of Goa.

(xx) Goa maintains that, in reality, the excuse of drinking water supply to Hubli – Dharwad, to justify Kalsa – Bhandura project, was invented much later, because it matched the provisions of National Water Policy, 1987, which gives preference to projects, which aim at mitigating drinking water needs.

Karnataka had considered a large all permutations and combinations – from Mahadayi

multipurpose/

hydroelectric power project to a choice of smaller projects but all these centered around the main aim of diversion of Mahadayi water out of the basin under any circumstances.

(xxi) To support its contentions that ‘shortage of drinking water in Hubli- Dharwad’ was an afterthought, the State of Goa has relied upon the minutes of the meetings held on September 10, 1996 in Panaji between Minister for Major Irrigation of Karnataka, and his counterpart in Goa, which mentioned that – ‘Karnataka State is facing a major problem of shortage of water for the Malaprabha irrigation

project which is designed for a command area of 2.15 lakh hectares, but is not able to irrigate more than 1.5 lakh hectares due to lack of water. It is asserted that it is in this context that Government of Karnataka has proposed to divert 4 tmc water from Kotani reservoir to Malaprabha dam and utilize 9 TMC of power generation besides diverting 3.8 tmc water from a second dam at Kalsa to Malaprabha' and nowhere in this proposal there was mention of water supply to Hubli – Dharwad.

(xxii) The State of Goa has detailed that the Planning Commission had constituted a Task Force to prepare the eco-development plan of Goa State in May 1981 under the Chairmanship of Dr. Swaminathan, Member, Planning Commission and this Task Force appointed a sub-group of top experts of CWC, and other water resource disciplines, to study and submit a report on Water Conservation and Utilization. It is pointed out that this expert's sub -group submitted its report in 1982, and assessed the average annual yield of the entire Mahadayi River Basin, (i.e.

including

water

resources

generated

but

neither

conservable useable quantity from the estuarine lower

reaches) as 3580 Mcum (126 tmc) and the corresponding 75% dependable flow would be approximately about 60% of 3580 Mcum i.e. 2148 Mcum (76 tmc). Thus, according to State of Goa,

the useful flow available for actual conservation, regulation and use from the Mahadayi river basin may be around 1350 to 1400 Mcum (47 to 50 tmc) only and this is the most reliable water resources estimate available so far, from an independent top expert committee of the Planning Commission.

Goa has stated that a Copy of the Report of the Task Force to prepare the economic development plan for the State of Goa under the Chairmanship of Dr. Swaminathan, constituted by the Planning Commission, in May 1981, has already been annexed as Exhibit D by the State of Goa, to its amended pleadings.

(xxiii) The State of Goa has stated that the Report of the Dr. Swaminathan Committee is of the year 1981, and has statistics and figures, as available prior to the year 1980. It

has been submitted that some of the latest techniques in the field of hydrology, which had become now available,

were not available at the time when the said Dr. Swaminathan Report was prepared.

It is stated that further, as compared to present day scenario, the length/span of the data, estimated population figures at that relevant time, as well as the other physiographical, hydro-meteorological and other environmental features, were less developed at that time, and at the time of the aforesaid study, various related enactments such as the Environment (Protection) Act, 1986; Forest Conservation Act, 1980 and declaration of Mhadei as Wildlife Sanctuary had not taken place and thus, the said Dr. Swaminathan Report was also limited by the various aforesaid and other factors.

(xxiv) Goa has pleaded that in 1989, NWDA (National Water Development Agency) made another estimate of the total water resources of the Mahadayi river basin – i.e. from

areas including the lower estuarine reach as 5332 Mcum (188 tmc) at average dependability and the yield at 75% dependability (the Planning Commission prescribed minimum dependability criteria for water resources

development projects) as 3164 Mcum (112tmc) and these NWDA's water resources assessments are now revealed to be based on erroneous assumptions of basic hydrological data such as rainfall, river discharge data. It is stressed that the estimate also blatantly ignored that water resources in the lower saline and estuarine reaches of the Mahadayi river basin which cannot be practically conserved and regulated for beneficial uses such as domestic and industrial water supply, irrigation and salinity control of the coastal stretch of lands.

(xxv) It is pointed out that considering the Report of the Task Force set up by the Planning Commission and the NWDA assessment of basin yield, the Government of Goa appointed a "Panel of Experts" for preparation of Master Plan for the long term needs of water potential of the Mahadayi river basin in Goa, and the Panel submitted its Report to Goa Government on 31.01.1999. It is stated that a copy of this Master Plan was supplied to Karnataka Government on 10.01.2000, and to the NWDA on

08.02.2000, and based on the studies carried out by the NWDA, this Panel assessed maximum yield available to Goa

as 827 Mcum. The State of Goa has produced extracts of their Report indicating how this figure is arrived at, as follows:

“4.6.0. The yield estimates of the Mandovi river basin available to the POE are therefore only what is available in the earlier NWDA studies of July 1989 for the entire basin area. The break-up of yield of the three States corresponding to the estimated 75% dependable annual yield of 3164 Mm3 for the entire basin is not available. Working it out approximately on Pro rata drainage areas basis in the three States, the break-up of 75% dependable flows would be: -

1.

2.

3.

Karnataka 375 sq.km. 584 Mcum

Maharashtra 77 sq.km. 120 Mcum

Goa 1580 sq.km. 2460 Mcum

TOTAL 2032 sq.km. 3164 Mcum

The overall runoff rate per sq. km. of drainage area is about 1.56 Mcum/sq.km. This general yield rate adjusted suitably for the variations in the rainfall at individual projects sites have not been made use of an arriving at an approximate idea of the Water Resources available at the projects identified and recommended for use in the Mandovi river basin Master Plan. The executive summary of their

Report is submitted in Volume IV of the Master Plan for Madei River Basin.

4.7.0 It is not possible or practicable to conserve and use the entire Water Resources of any river basin. In the case of Mandovi river it is seen that about 509 sq.km. of the basin area in its final reach is in salinity and very fragile river zone. The river and some of its tributaries are also used for navigation by boats, launches and barges to transport people, materials and minerals. The limited area that can benefit by irrigation in Goa is located in the middle reaches of the basin and any attempt at Water Conservation in this reach would submerge even these limited areas available. These Water Resources conservation limitations have also to be taken into account in planning optimum long-term Water Resources management in this basin in Goa State. In this region there is also the

existing inland water transport system of men and material by barges and boats. Upstream of this last reach of 509 sq.km. drainage area of the Mandovi river basin, there is about 541 sq.km. area at low altitudes above sea level. This is the only area available in Goa State that can be profitably cultivated and irrigated. Most of the village population is also concentrated in this reach. Any conservation attempt in this reach will submerge the only area available for cultivation and displace people without any alternative area for rehabilitation.

Thus, in Goa State virtually no conservation of the Mandovi river water resources of 509 + 541 = 1050 sq.km. area in the two lower reaches of the river appears practicable.

There are also the fragile ecological limitations of this estuarine river and sufficient quantity of fresh water must keep flowing in the river even after full conservations and diversion of water and development of projects for other beneficial uses so that the existing delicate balance of the fresh water and saline water in the estuary and lower portions of the basin are not jeopardized. Bearing all these aspects in mind Water Resources drained from about 1050 sq.km. in Goa State in the lowermost reaches of the basin have to be left well alone from any plan of conservation and diversion for irrigation, water supply and other beneficial consumptive uses.

In substance, out of a total drainage area of 1580 sq.km. of this basin in Goa State, as on outer limit, it may be possible or practicable to conserve and use the water resources generated from a drainage area of only about 530 sq.km. in the uppermost region of the river basin located in Goa. At the overall rate of 1.56 Mcum/sq.km. this would mean maximum availability of not more than 530 x 1.56 = 827 Mcum from drainage area of the river in Goa. For its balance long term water needs of the basin and surrounding areas, Goa State has to depend upon Water Resources

generated upstream in the 452 sq.km. basin areas located in Karnataka and Maharashtra. In substance, out of a total drainage area of 1580 sq.km. of this basin in Goa State, as on outer limit, it may be possible or practicable to conserve and use, the water resources generated from a drainage area of only about 530 sq.km. in the uppermost region of the river basin located in Goa. At the overall rate of 1.56 Mcum/sq.km. this would mean maximum availability of not more than 530 x 1.56 = 827 Mcum from drainage area of the river in Goa. For its balance long term water needs of the basin, and surrounding areas, Goa State has to depend upon Water Resources generated upstream in the 452 sq.km. basin areas, located in Karnataka a nd Maharashtra."

(xxvi) Goa asserts that the contention raised by the State of Karnataka, inter alia in para 9.4 of its Claim Statement dated 2.01.2013, to the effect that the State of Goa has

raised unsubstantiated and unfounded objections to the yield studies conducted by CWC, is emphatically denied. According to the State of Goa, it repeats and reiterates all the objections hitherto raised by it in its Claim Statement and other pleadings filed before this Tribunal, and that the data used by CWC in arriving at the said yield

studies are completely unreliable, and the methodology is unreasonable. It is submitted that the CWC yield study suffers from certain glaring and patent defects.

In its pleadings Goa has raised the following objections to the CWC Report:

(xxvii) Objection 1:

The CWC in its report has excluded the rainfall data available at the Panaji Station from the years 1901-1927, although the data for the said years was readily available and though the State of Goa had emphatically made a request for including such data in the computation of yield of Mhadei Basin. The ostensible reason given by CWC in excluding the rainfall data from Panaji Station for the years 1901-1927 is that although the Panaji Station lies in Mhadei basin, it is located near the confluence of the river with the sea. It is submitted that there is no basis or reason whatsoever, which has been stated in the CWC report in support of its contention that rainfall data of stations near the confluence, points should be excluded. The fallacy and

absence of reason in the said contention of CWC is manifest

from the fact that the CWC itself has included the rainfall data from the Panaji Station for the years 1928 to 2000 in computation of yield of Mhadei basin in the said yield studies. In any event of the matter, having excluded the said data for the years 1901-1927 on the said basis, the CWC could not have included data from the said Panaji Station for the subsequent years for computation of yield of Mhadei basin.

(xxviii) Objection 2:

It is submitted that the CWC yield study of March 2003 records that the discharge measurement at Ganjem site prior to the year 2001 was based on 'float observation' method. It is pertinent to note that the said CWC yield study report itself admits [page 38 of the study] that due to the use of float observation method, 'the discharge figures up to year 2000 may have large error as compared to current meter observation'.

It is stated in the said report itself that data for the period 1979-80 to 1997-98, which was continuously

available and has been used, was observed by the ‘float

observation' method. From the aforesaid, it is clear that the CWC report itself admits to large errors in the measurement of discharge data at Ganjem site prior to the year 2000. Having admitted to such large errors creeping into the discharge measurement by 'float observation' method, the CWC report makes a feeble attempt to justify the same by comparing the aforesaid data with data obtained by 'current meter' method for just one or two yea rs after the year 2000. It is submitted by Goa that relying upon such data of a short period of time as one or two years to justify that there are no errors in the data by 'float observation' method, is completely incorrect and untenable. It is further submitted that the CWC had carried out the aforesaid yield study based on own data and methodology without having any consultation with the State of Goa and particularly at the stage of data augmentation and finalization of yield. This was objectionable, more particularly since there were no established protocol for such assessments or studies in place.

(xxix)

Objection 3:

The CWC in their yield study of 2003 has taken the entire catchment area of the Mahadayi/ Mandovi basin for the purpose of determination of 75% and 50% dependable yield. It is submitted by the State of Goa that in a river basin for the state that is most downstream and adjoining the sea/ocean, the yield from the entire catchment area, right up to the land-sea boundary, is not usable. As the river enters its estuary phase, the lands become very flat and there are no well-defined drainage paths that bring the water from the rain falling on this land area to the river. The water from the rain falling on this area does not accumulate in the river, and drains out to sea/ocean directly across the land-sea boundary.

The final reach of the river before it meets the sea/ocean is called tidal reach, in which the flow is bi-directional. At certain times, particularly during high tides, the sea water flows in to the river and renders the water in

the river saline and of no use for consumption whether by human beings or animals. For all these reasons, it is standard practice to exclude these areas from the yield

studies. The yield of the basin for the purpose of allocation is taken up to a certain point on the river some distance before the river actually debauches in to the sea/ocean. This is elaborated from following precedents and examples.

- The Krishna Water Disputes Tribunal has allocated the yield of the Krishna basin only up to Prakasam Barrage.
- The Narmada Water Disputes Tribunal has allocated the yield of the Narmada basin only up to the Sardar Sarovar dam site.
- The Cauvery Water Disputes Tribunal has allocated the yield of the Cauvery basin only up to an anicut known as the Lower Anicut.
- The Godavari Water Disputes Tribunal has allocated the yield of the Godavari basin only up to the

Dowlaishwaram Anicut.

The area to be thus excluded depends mainly on the topography of the estuarine region and hydraulic characteristics of the river as it nears the land-sea boundary. In the case of Godavari, the area thus excluded is 3545 sq.km. where as in Krishna basin the area thus

excluded is 1868 sq.km. In comparison to this the estuary area to be excluded in Mandovi River is only 1050 sq.km, which in fact was not excluded by CWC.

(xxx) Objection 4:

The CWC in their yield study of 2003 has derived the regression equation as below:

R=0.8789 *P-49.6451.

The State of Goa has pleaded that it made an attempt to verify this equation, using the same data as has been used by CWC in deriving this equation, but the State of Goa was unable to get the same equation as has been derived by CWC. It is therefore maintained that the regression equation, as derived by CWC is erroneous, which can be seen in table 4.1 of the IIT Bombay Water Yield Study Report.

(xxxi) The State of Goa has pleaded that the basin area of the interstate Mandovi River in the State of Goa is 1580 sq km., but in coastal rivers, the water resources from the entire basin area can seldom be used gainfully, and as the river

approaches the land-sea boundary, the sea water intrudes into the river and renders a part of the river reach saline; the lands are flat and the rain falling on these lands does not accumulate in to the river and drains out directly in to the sea; and in these low-lying lands it is not possible to construct any water storage and abstraction structure. It is thus estimated by the State of Goa, that in the case of River Mandovi the area, thus unusable, is 1050 sq.km.

It is stated that due to the flat topography, and coastal estuarine conditions, the water conservation and regulation projects are possible only in the upper catchment, near the Karnataka-Goa border or Maharashtra-Goa border, and therefore, Goa is heavily dependent for its sustenance on the water resources generated in the basin areas of Karnataka and Maharashtra.

(xxxii) It is submitted that the State of Goa had approached the Indian Institute of Technology (Bombay) through its civil engineering department, which is considered a renowned and expert body, for undertaking hydrological study in

respect of Mhadei River basin, and Indian Institute of

Technology (Bombay), in turn had deputed two of its eminent faculty, namely Prof. V. Jothiparkash and Prof. M. C. Deo, Professors in the Department of Civil Engineering g, I.I.T. (Bombay), to carry out the said work.

It is mentioned that upon examining the available rainfall, gauge and discharge data of the Mhadei basin, the said IIT (Bombay) team, comprising Prof. V. Jothiparkash and Prof. M.C. Deo, have submitted their detailed Report dated 16.12.2014.

(xxxiii) Goa, thus, states that from the analysis of the said Report, it is apparent that there are serious discrepancies in the data compiled by CWC and/or IMD, as explained herein below:

(a)

The CWC was making discharge observations by a method known as the “float method” up to the year 2000. From the year 2000 onwards, the CWC changed to a method known as “current meter method”. The latter method is technically known to be more accurate than the former. Therefore, it was expected

that since the analysis was being presently undertaken

taking into account 13 years of current meter data, the same would lead to more reliable yield studies.

(b)

It has been however observed in the said Report that when various scientific checks were applied to this data, it was found that the data from the year 2006 onwards does not pass the said checks. The checks applied and the outcome thereof is explained in detail with the help of graphs etc. in paras 3.2.3 to 3.2.4 of the said Report. It is submitted that is for the CWC to explain the reasons for this discrepancy and explain as to whether it is possible to correct the errors reported, because otherwise the study would be reduced to use of data only up to 2005;

(c)

In the said Report, it is thus observed that the discrepancy in the discharge data, after 2005, indicates a serious deficiency in the observation procedures by the CWC. It is therefore submitted that

a serious doubt arises as to whether the Report of CWC contains similar procedural deficiencies in the earlier years also. Incidentally, the State of Karnataka

is seeking to place reliance on the same data, which has been used by CWC, for the purpose of carrying out the yield study (2003) of the Mhadei basin.

(xxxiv) The Central Water Commission (2003) Report, has been challenged by the State of Goa, also, on the following grounds:

(a)

Besides the above, the Report also reveals that the runoff expressed as a percentage of rainfall, known as the “runoff co - efficient, also known as the “runoff factor” has worked -out to, as high as, 90%. In some years, it is more than even 100%. The hydrologic experience suggests that the runoff co-efficient is typically between 35 to 50%. In the present case however; the runoff co-efficient being 90% or even more suggests that for the years prior to 2005, there is a discrepancy in either the runoff data or the rainfall data or both.

(b)

The said report has also reviewed the earlier studies conducted by NWDA, CWC and IISc. It has also been observed that the CWC Study (2003) and the IISc

Study had used the same data set. However, the both the said studies have come out with different regression equations.

(c)

In the said Report, it has also been observed that in said earlier studies, the run-off over the entire catchment area had been taken as the ‘yield’ of the basin.

(d)

It has been observed in the said Report that run-off and yield are two different concepts. A reach of the river before it finally meets the sea/ocean is affected by intrusion of saline water. The flow in the river in this reach is unfit for any productive use for human beings, animals or agriculture. Also, a strip of the catchment close to the coast drains directly into the sea / ocean and does not contribute to the river flow. Therefore, it is necessary to exclude the rainfall falling in this part of the catchment and also to exclude the

flow in the saline reach from consideration of utilizable water resource. This run-off which includes only the utilizable flow / water resources is called the “yield”.

292

(e)

The said Report has assessed the catchment area to be thus excluded as 501 sq.km and has computed the yield only on the remaining catchment area.

(f)

Despite the run-off and/or rainfall data observed to be unreliable, the said experts have made an attempt to analyze the yield of River Mhadei using the said available data, in compliance with the directions issued by this Tribunal vide its Order dated 03.09.2014.

(g)

It is however maintained by the State of Goa that the States of Karnataka, Goa and Maharashtra, as well as CWC, have all conducted their respective hydrological studies, which have come out with mutually inconsistent conclusions regarding the yield etc.

It is further submitted that the details of the inconsistency in data is already brought out in the

Report prepared by Prof. V. Jothiparkash, which is already brought on record of the case.

A copy of the hydrological data in possession of Goa has been annexed as Exhibit B to its Submissions

293

in compliance with paragraph 4 of the order dated 03.09.2014 passed the Tribunal.

A chart showing comparison of the physiographical features of the basin and the hydro-meteorological characteristics of the region has been annexed as Exhibit C in support of its aforesaid submissions.

(xxxv) It is asserted that both Karnataka's & Maharashtra's port ion of the Mahadayi river basin areas are in the initial and head reaches of the river in the rugged area of Western Ghats, and comparatively the rainfall in these head reaches of the Mahadayi River and its tributaries are much higher than in the middle and coastal reaches of the basin in Goa State. It is mentioned that the rugged areas in head reaches of the

Mahadayi basin in Karnataka and Maharashtra States have thick forests and scant area for irrigation and sparse population and, therefore, a substantial portion of the dependable and available fresh water resources of the Mahadayi River on which Goa's social, economic and environmental sustenance depends, is generated in the

drainage areas in upper reaches of the basin in Karnataka and Maharashtra.

(xxxvi) According to Goa one of the major issues for adjudication in the present dispute is the reliable quantity of water at 75% dependability flow of the basin, which is only available for beneficial use by conservation and regulation, after excluding water resources generated in the lowest estuarine, saline, tidal and coastal reaches of the Mahadayi river and its tributaries in Goa, which the State of Goa has been asserting over the years.

(xxxvii) It is emphasized that the action of commencement of constructing the interconnecting channel, by Karnataka, between Kalasa Nallah and Mahadayi River, which is already in the final stages of construction, tantamount to annexation of a part of watersheds of water deficient Mahadayi Basin to the water surplus Krishna Basin, rather than a normal diversion of the rivulet which is a totally uncommon, unilateral and unacceptable kind of diversion inasmuch as it is changing the course of the western

direction flowing river to eastern direction flowing and the

process that is being adopted by State of Karnataka, in case of Kalasa diversion, would tantamount to killing of the river as well as this pristine region of India.

(xxxviii) The State of Goa points out that the Kalasa-Bandura diversion project was initially granted an ‘In - Principle’ clearance by CWC, evidently only on water availability angle, and the aforesaid ‘in - principle clearance’ was also kept in abeyance by CWC later on, however, Karnataka went ahead with construction of Kalasa diversion works stating that they were taking up the works in their area, with State funds, alone, and limited to non-forest areas where MoE&F clearance is not necessary.

Goa states that the main condition to the said ‘in principle clea rance’ was that State of Karnataka should not raise any infrastructure and make provisions for conveying quantum of water, that was allowed in the said clearance, but the ongoing works of Karnataka totally breaches this condition inasmuch as once the interconnecting channel is completed; even Karnataka, if at all they intend to do so,

cannot control the quantum of water flowing into

Malaprabha River from Mahadayi Basin. It is further stated that Karnataka had never shared any technical information regarding the construction, including the project details, even to the Central Water Commission, and not at all to the States of Goa and Maharashtra and all this is being done in complete violation of the Law.

(xxxix) Goa points out that the Mandovi River, called Mhadei in upper reaches, originates in Karnataka, and taking advantage of being situated at a higher altitude, Karnataka had persistently pursued the plan of diverting waters of Mhadei River eastwards, to Malaprabha River in Krishna basin. It is stated that firstly, it proposed to divert 5 tmc of water to another west flowing River Kali Nadi, for hydro power generation, and when this was resisted by the Goa government, the plan was changed to diversion of 9 tmc of water, from various locations, to east flowing River Malaprabha, to augment the supplies in Malaprabha basin for all uses. It is pointed out that when this was also resisted, Karnataka, somehow obtained an “in principle”

permission for diversion of 7.56 tmc of water to

Malaprabha reservoir, purportedly to meet drinking water

shortage in Hubli-Dharwad cities, and Karnataka has reported that the yield at Malaprabha reservoir site has been only 26 tmc, much less than the design yield. However, according to Goa, even 26 tmc is sufficient to meet not only the present, but also future water needs of Hubli-Dharwad cities, and yet have sufficient water for irrigation also.

(xl)

It is submitted that the In-Principle Clearance dated 30.04.2002, issued by the Ministry of Water Resources, Government of India, to the State of Karnataka, was for diversion of 7.56 tmc of water from Mhadei basin to Malaprabha through the implementation of Kalsa and Bhanduri Nalla Scheme from 'Water availability angle' only. It is submitted that whenever any State proposes to construct any major medium irrigation, such State has to obtain an Investment Clearance from the Planning Commission, which is granted on the basis of the recommendations of the Technical Advisory Committee

(TAC) of the Ministry of Water Resources.

298

The said “In - Principle Clearance dated 30.04.2002” was given to Karnataka, subject to fulfilment of the conditions as stated therein. One of the conditions stipulated in the said clearance was that the Government of Karnataka will furnish all required design details to enable the CWC to satisfy itself that Karnataka does not develop technical capability for diversion of more water than that mentioned in the said clearance at later stage.

The State of Goa has asserted that to the best of its knowledge, the State of Karnataka had never submitted the said required design details to CWC, and on the contrary, had commenced work without taking any other, and further, permissions, as required by law.

(xli)

According to the State of Goa, the construction work which was being carried out on the said Kalsa and Bhanduri project by the State of Karnataka, despite the said in principle clearance having been kept in abeyance; despite not having obtained the investment clearance, as stipulated

in the Clause (d) of the said in principle clearance; despite not having obtained the environmental & the forest

clearance; is in complete violation of the terms and conditions of the said clearance itself, as well as the other provisions of law and that on this ground itself, the said project would be liable to be stopped.

(xlii)

It is stated by Goa that the State of Karnataka and State of Maharashtra cannot, and do not have the right to, divert water from Mahadayi Basin into Malaprabha Sub-Basin and Tillari Basin, respectively and such work on the part of the State of Karnataka and State of Maharashtra is not only illegal and without authority of law, but would have serious and devastating effect on the environment, life, nature, economy and survival of the people of Goa.

It is asserted that if the proposed actions of the State of Karnataka and State of Maharashtra are allowed, whereby the water from the Mhadei River is allowed to be diverted to other Basins, the same would have devastating effect on the State of Goa.

(xliii) Goa maintains that Mhadei River originates and flows

through the entire Western Ghats, and the Western Ghats

and Mhadei River are environmentally and naturally inextricably interlinked, and any interference in that nature could be disastrous. It is stated that the Western Ghats is a mega biodiversity hottest hot spot, the major portion of which is declared as a Protected Area and the entire Western Ghat has been providing contiguous corridor for safe movement of wildlife in the State of Goa.

It is mentioned that the Western Ghat acts as a catchment area for all rivers, including Mhadei and the Western Ghat comprises in it a corridor for safe movement of wildlife, such as tigers. It is averred tht the areas of Western Ghats on both sides of the Mhadei River have been declared as Mhadei Wildlife Sanctuary consisting of an area of 208.48 sq. km. which spreads across Sattari Taluka, vide Notification dated 03.06.1999.

It is averred that the entire Mhadei Wildlife Sanctuary is getting nourished from the waters of Mhadei and Mhadei Wildlife Sanctuary is also nourished by Surla River which is its tributary which leads Mhadei River to Uste. It is

maintained that the flow of Mhadei River brings huge

amount of macro nutrients, which gives rise to diverse flora and fauna in the low-lying areas of Mhadei Wildlife Sanctuary and River Mhadei passes through the sanctuary and is the source of water for the sanctuary.

(xliv) It is stated that if any water from Mhadei River is diverted by the State of Karnataka, this flow of macro nutrients would stop, which would directly result into affecting the diverse flora and fauna in the low-lying area of Mhadei Wildlife Sanctuary and thus, the diversion of water from Mhadei River is going to have a direct impact on the vegetation, agriculture and ecology and consequently, the wildlife in the Sanctuary.

(xlv)

The State of Goa states that Mhadei Wildlife Sanctuary has been divided into seven different types of habitat, namely Rocky cliffs, vegetation above 800 meters MSL, River bed vegetation, Riparian forest, Natural grasslands, Lateritic Plateaus and Myristica Swamps but the level of moisture plays an important role in the vegetation in the aforesaid

areas. It is mentioned that pertinently, one of the tributaries of Mhadei River, i.e. Kalsa River after entering

the Goa has a deep fall called “Ladkecho Vozar” and the moisture generated from the fall is very vital for the vegetation around this area. It is stated that some vegetation and habitats which specifically rely on such moisture would be eliminated, if the water from the Kalsa River is diverted, as is sought to be done by the State of Karnataka and this is going to have multiple disastrous effect on the vegetation and consequently, the wild forest inhabitants.

(xlvi)

The State of Goa states that in the said Mhadei Wildlife Sanctuary, there is bio-diversity consisting of 67 species of trees, including 35 endemic and 12 rare whereas there are 42 species of shrubs, out of which 10 are endemic and 4 rare. It is informed that further, 18 species of climbers consisting of 4 endemic and 2 rare and there are 14 species of herbs, of which 5 are endemic and 2 rare species.

It is mentioned that the entire Surla River is covered with Tropical Semi Evergreen Forests with thick growth of

cane (Calamus spp), and if the water of Kalsa River is diverted by the State of Karnataka, the same would

adversely affect fresh flow of water in Surla River Valley, which would adversely affect the change in environment as well as micro-climatic condition of the area.

(xlvii)

The State of Goa states that Mhadei Wildlife Sanctuary consists of different types of fauna, animals, including those contained in ‘SCHEDULE 1’ OF THE Wildlife Act. Tigers are again endangered species in the World and there are Sloth bears, Leopard, Mouse deer, Malabar giant squirrel and Indian Pangolin which are also endangered and vulnerable status as per IUCN categorization. It is stated that there are endangered, vulnerable and threatened species, and other fauna that are endemic and classified as Rare and there are also Mammals like Slender loris, Flying-squirrels and Giant squirrels are also reported to be raring in the Sanctuary.

The State of Goa states that it has been now well established that in the Mhadei Wildlife Sanctuary there exists Tigers as per the All India Tiger Estimation, 2014 and presence of five Tigers, have been found on the basis of

results of the Census undertaken in April 2014.

(xlviii) According to Goa, if the flow of the water from Mhadei River is in any way affected or diverted, the same would directly have impact on the eco-system and prey base for tigers in the said Sanctuary which would be directly affected and jeopardized.

Goa mentions that there is unique practice of gene pool conservation in Mhadei Wildlife Sanctuary, wherein local community never kill large population of fresh water carps in the River as they are treated as sacred.

(xlix)

Goa mentions that Mhadei Wildlife Sanctuary is the only habitat in the World for the “Wroughton’s Free Tailed Bat” and this species is highly endangered and rare for whom Mhadei Wildlife Sanctuary serves as the best foraging ground. It is stated that one of the reasons for establishing the Sanctuary is, because of this unique species and these species are very sensitive and slightest variation in microclimatic condition of the area would endanger these species.

The State of Goa states that Kalsa River (Surla in Goa) meanders through Mhadei Wildlife Sanctuary, and acts as a breeding ground for species of fresh water fishes and amphibians that, in turn serves the species and animals, such as Otters, Fishing Cats, Marshy Crocodiles, etc.

(l)

Goa maintains that the proposed diversion of water by the State of Karnataka and State of Maharashtra would increase the salinity of water and there will be increase in the tidal base water flow due to which the residents living on the banks of Surla River, i.e. Villages of Surla, Derodem, Codal, Vainguinim within the villages of Nanoda and Uste, besides the Sanctuary, would suffer immensely on account of depletion of River water and in addition, the source of underground water would also be completely depleted.

(li)

The State of Goa has stated that Mhadei Wildlife Sanctuary is an important place for nature loving people and has a potentiality of developing the area for Eco-Tourism. It is

stated that there are perennial and seasonal waterfalls, such as Ladkecho Vazor, Ivrem or Choraoneum and there is lot of white water rafting, which is the only river aquatic

sport in the State of Goa which goes up in the Mhadei River. It is claimed that if there is any diversion of water from the said River, all these activities would greatly suffer.

(lii)

What is stressed is that the action of Karnataka is not only in contravention of the Doctrine of Public Trust, but also in violation of Wildlife Protection Act because in terms of Section 29 of the Wildlife Protection Act, no person shall destroy any wildlife or destroy or damage the habitat of wildlife by any act or divert, stop or enhance the flow of water from the Sanctuary without the permission of the Chief Wildlife Warden, and such permission cannot be granted without the consultation of the State Government and the Board for better management of the wildlife. It is pleaded that the entire activity proposed and part of it being carried out by the State of Karnataka is therefore illegal and in breach of not only the Wildlife Protection Act but also the Environmental Protection Act.

(liii)

The State of Goa maintains that the damage and some of the multiple problems, due to diversions, that would be

caused, apart from several other violations and problems, are as under:

- The microclimate of Mhadei river basin will undergo major changes that in turn will adversely affect vegetation of the area.
- Migration of Wildlife and even extinction of certain species.
-
-
- Depletion in groundwater and freshwater aquifers.

Increased man - animal conflicts.

Livelihood issues of the population residing along the river course including bio-diversity depending from time immemorial.

(liv)

The state of Goa states that the loss in all this cannot be

quantified as it is not ordinary article of commerce, but if at all the other incidental effects in-terms of money has to be quantified the same would be as under. It is pointed out that the loss that would be caused by the said diversion sought to be done by the State of Karnataka and State of Maharashtra, if permitted, would be around Rs. 14,091/- Crores. It is mentioned that the Ministry of Environment

and Forests in the year 2004 framed Guidelines for computing the environmental losses on account of four parameters of soil erosion, effect on hydrological cycle, wildlife habitat and microclimate upsetting of ecological balance. It is claimed that applying the aforesaid Guidelines and taking into account the area of the Mhadei Wildlife Sanctuary is 208.48 sq.km. The fact that 2/3rd of its area falls in Tropical evergreen, Semi evergreen and Moist deciduous forests. The same would be around 138.98 sq.km. with a canopy density of 0.8. The total loss which would be caused is as under:

Mhadei Wildlife Sanctuary : 138.98 sq.km.

(1 sq.km. : 100 Ha i.e. 13,898 Ha).

Environmental losses/Ha.

: Rs.126,74 lakhs

(Over a 50-year period for a canopy density of 1.0)

Total quantum of environmental Losses : 13,898 Ha x 0.8 x Rs. 126.74 Lakhs = 14091,46,01,600

i.e. Rs. 14,091/-Crores.

(lv)

According to Goa, it being a riparian State, is entitled to use all the waters that flows into its territory of all the

tributaries of Mhadei River including that coming from upstream.

Goa states that as per the Doctrine of Public trust and Precautionary Principle, by no standard of imaginations, the State of Karnataka and State of Maharashtra, can be permitted to carry on their construction, and divert the water from Mhadei River into any other basin or for that matter, to divert any water from Mhadei River. It is claimed that the same would have devastating effect on the ecology, sociology and the economy of the people and the State of Goa.

(lvi)

It is pointed out that the Goa State Pollution Control Board, (hereinafter referred to as the ‘GSPCB'), under the mandate of the National Water Quality Monitoring Programme, monitors water quality at eight locations along the Mhadei river and its tributaries in the State of Goa and the purpose of this monitoring as mandated by the Central Pollution Control Board is to monitor various physical and chemical

parameters like the pH, Conductivity, DO, BOD, Coliform count, etc., which are analyzed on monthly basis. It is

mentioned that selective metal contents are analyzed twice a year.

(lvii)

It is emphasized that the monitoring is carried out at the following locations as per the Central Pollution Control Board guidelines along with their classification:

a)	River/tributary Khandepar at Codli	Fresh water	Class C
b)	River/tributary Khandepar at Opa	Fresh water	Class C
c)	River/tributary Mhadei a Dabos	Fresh water	Class C
d)	River Mhadei at Tonca, Marcela	Saline/brackish water	Class-SW-II
e)	River Mhadei at Panaji (near Mhadei Bridge)	Saline/brackish water River	Class-SW-II
f)	Mhadei at IFFI Jetty, Campal	Saline/brackish water	Class-SW-II

g)	River Mhadei at Hotel Marriott, Campal	Saline/brackish water	Class-SW-II
h)	River Mhadei at Amona	Saline/brackish water	Class-SW-II

311

(lviii) It is stated that the GSPCB has been collecting these water quality analysis data for the last 10 years, i.e. from 2004 to 2014, and at present all the parameters are within the Central Pollution Control Board prescribed limits, and do not show any definite trend either seasonally or annually, except turbidity and faecal coliform.

(lix)

The State of Goa states that the Central Pollution Control Board, New Delhi has classified the stretches of river Mhadei into various categories, which are as under:

(a)

Class – C (fresh water) – from starting point where it is called Mahadayi and then Madri up to its confluence with Ragada and northern boundary of Nirancal;

(b)

Class – SW-II (saline/brackish water) – from point of confluence with river Ragada up to Arabian Sea;

(c)

Ragada tributary to Mhadei River – Class – C (fresh

water) – from starting point of its confluence with

Mhadei river;

312

(d)

Khandepar tributary to Mhadei River

1. Class – C (fresh water) – from staring point including Dudhsagar river to Kali Nadi up to Opa Weir;

2. Class – SW-II (saline/brackish water) – From downstream of Opa Weir to its confluence with Mhadei river;

(e)

Class – SW-II (saline/brackish water) – Cumbharjua Canal connecting River Zuari and Mahadei.

(lx)

What is asserted is that, it is pertinent to note that the proposed construction of storage and/or abstraction of water by the State of Karnataka, and by the State of Maharashtra, on the upstream stretches of river Mhadei will reduce the quantum of water flowing in river Mhadei and its tributaries, and this will increase the concentration of pollutants increasing the stress on water treatment

plants at Opa and other water treatment plants.

It is further stated that non-availability or reduced availability in the perennial water source due to abstraction

in upper catchment area will also have negative impact on effective groundwater recharging thereby affecting the ground water availability. The ground water also provides water for irrigation.

(lxi)

Goa states that the Central Pollution Control Board has devised a scheme for classification based on existing traditional organized use being adopted for which the first step is to identify the uses. The following uses are identified for fresh waters:

Fresh Waters

A.

Drinking water sources without conventional treatment but after disinfection; Outdoor bathing (organized);

B.

Drinking water source with conventional treatment followed by disinfection;

C.

D.

E.

F.

G.

Properties of wild life;

Fisheries;

Recreation and Aesthetics

Irrigation

Industrial Processing

314

H.

I.

J.

K.

L.

M.

N.

O.

P.

Q.

R.

S.

T.

U.

Industrial Cooling

Navigation

Controlled Waste Disposal.

Fresh Waters including estuaries and coastal waters

Salt pans

Shell fishing

Contact water sport

Commercial fishing

Recreation (non-contact)

Chemical Recovery

Industrial cooling

Harbour

Navigation

Controlled waste disposal.

Fresh Waters including estuaries and costal water

i.

ii.

iii.

iv.

v.

Salt pans

Shell fishing

Contact water sport

Commercial fishing

Recreation (non-contact)

315

vi.

vii.

Chemical Recovery

Harbour

viii. Navigation

ix.

Controlled waste disposal

(lxii)

The State of Goa states and submits that the scheme of classification to deal with such multiple use situations, is evolved based on that use, which demands the highest degree of water quality and the use thus identified is referred to as the designated best use Industrial cooling and it can be emphatically stated that any change or reduction in the flow of fresh water in river Mhadei will not only cause irreparable and irreversible damage to the environment, but the same will also prevent the flushing out of the pollutants, which are caused due to the various factors in river system. It is further stated that in such an event, the

waters of River Mhadei and its tributaries will become unusable and beyond any possibility of treatment for sustained use, and this will be disastrous for the entire system dependent on the river basin.

(lxiii)

It is stated that trans-basin diversion of the Mandovi River and its tributaries by Karnataka would result not only in loss of valuable, limited water resources and its beneficial uses downstream in Goa State, but also a total loss of cheap and environmentally clean hydro power potential available within the State. It is stated that the water requirement for hydropower generation within the basin in Goa could thereafter be beneficially used for domestic, industrial, tourism, water supply needs and for irrigation and to sustain existing navigation and preservation of Goa harbor, but the proposed outside the basin diversion of Mahadayi river waters by Karnataka would deprive Goa of all the above benefits and would be clearly detrimental to the in basin beneficial uses of Goa State and its inhabitants.

(lxiv)

It is emphasized that the state of Goa is virtually entirely dependent upon waters from Mahadayi/Mandovi River whereas Karnataka has within its state the benefit of

several interstate rivers apart from intra-state rivers. It is pleaded that Malaprabha is a tributary of the Krishna River and the requirement of sub basin of Malaprabha could be adequately met by the water allocation made in favour of

the Karnataka in the award rendered by Krishna Water Disputes Tribunal. It is stated that even assuming, without admitting, that the small so called alleged need of Hubli/Dharwad water supply is not a pretext for trans-basin diversion, the alleged water supply requirement can easily be met by a marginal reduction in irrigation uses from adequate water resources available in Malaprabha sub-basin and it can also be met from other west flowing rivers flowing exclusively in Karnataka such as the Kali, the Bedti, etc.

It is pointed out that the Kali basin adjoins and is closer to Hubli/Dharwad towns and on the contrary Goa has no other alternative resources to meet its requirement for drinking water in addition to its other needs viz. ecological, environmental and irrigation needs. It is stated that as per the water balance study report (1989) prepared by National Water Development Agency (a society of Ministry of Water Resources) the Malaprabha basin is a water surplus basin and thus, there is no justification for the proposed transfer

by Karnataka.

(lxv)

It is submitted that in the present case, the question involved is not merely that for an “Inter -State basin transfer within the States of Karnataka and Maharashtra, but the question involved is whether such trans-basin diversion which is bound to very seriously affect the rights of lower riparian States, like the State of Goa should be permitted. It is stated that in fact, the proposal of trans-basin diversion, if proceeded with by the States of Karnataka and Maharashtra is bound to destroy the Mahadayi basin, the Mahadayi River and the people of State of Goa, who depend almost entirely upon such River basin of such River

for their very sustenance and wellbeing. It is averred that the trade, occupation which have been carried on for centuries stand risk of being wiped out and the navigation and transportation through Mahadayi River, which is virtually the lifelines of the economy stand at serious peril. It is pleaded that highly eco-sensitive regions, including the Khazans, Puran Xeti, etc. shall be rendered extremely vulnerable.

What is maintained is that any tampering with the Mahadayi River basin or Mahadayi River in the manner

proposed by the States of Karnataka and Maharashtra or even otherwise, is bound to increase the salinity caution, thereby rendering practically the whole Mahadayi River in the State of Goa unfit for drinking water purposes and the increase in the salinity is bound to have several other disastrous effects upon the marine and human life as well. Several eco-sensitive spots are bound to be destroyed. It is emphasized that the sea water intrusion will seriously affect and even destroy the forests and portions of Western Ghats not merely forming a part of the State of Goa, but also the States of Karnataka and Maharashtra and several heritage structures and traditional occupants, farming practices will run serious risk of destruction. In these circumstances, it is submitted that trans-basin or inter-basin diversion of waters from the Mahadayi basins or the Mahadayi River is not liable to be permitted.

38.

However, at this stage, it may not be necessary to notice any further detailed pleas taken by the States of Karnataka

and Goa, on account the interim order dated 27.07.2016 passed by this Tribunal, whereby an interim application, being I.A. No. 60

of 2015, filed by the State of Karnataka was rejected. In the aforesaid Interim application, very detailed facts had been given by the State of Karnataka, seeking permission to divert 7.56 tmc of water, outside the Mahadayi Basin, through Kalasa-Bhandura Channel to Malaprabha Sub-basin, and very detailed pleas had been taken by the State of Goa, raising a grievance against the construction of the aforesaid diversion channel and other connected works, by the state of Karnataka, for the said Kalsa Bandura Project, for taking water outside the Mahadayi Basin. At this stage, it would be pertinent to notice certain minimal facts pertaining to I.A. 60 of 2015:

(i)

By filing the said application, IA 60 of 2015, the State of Karnataka had prayed before this Tribunal, to permit it, at its own cost, to lift or pump 7 tmc of water annually from Mahadayi basin to Malaprabha basin, during the months of monsoon, for meeting the irrigation requirement, drinking water requirement etc., in the drought affected areas in the Malaprabha basin. According to the State of Karnataka, the

application was filed because of the claimed un-anticipated

321

extreme

drought

conditions

that

had occurred

in

Malaprabha basin, which were capable of being taken care of, by the relief sought for in the application. Detailed and elaborate pleas were taken in the said interim application, which need not be noticed at this stage.

(ii)

The applicant State of Karnataka had, inter alia, averred in the application that allocation of 7 tmc of surplus water in each year at 75% dependability available in the Mahadayi Basin at the proposed Kotni Dam site for utilisation in the Malaprabha basin

under the

three

projects, as

formulated in the amended statement of claim, would not cause any loss either to the State of Goa, or to the State of Maharashtra, since the water proposed to be lifted under the Interlocutory Application was, at present, unutilised by the State of Goa and it is running to Arabian Sea, as waste.

(iii) It was also stated in the Application that in the event the State of Karnataka succeeding in establishing its claim, inter alia for allocating 7 tmc of surplus water in Mahadayi basin, the relief prayed for will be duly accounted for, and adjusted against the overall claim of 24.15 tmc.

322

(iv) It was stated by the applicant State that the present stated utilisation by the State of Goa in Mahadayi basin is not more than 9.395 tmc, whereas the water available in Mahadayi basin, according to State of Goa, is 108.72 tmc, although the applicant State of Karnataka contended that the total water available is 199.6 tmc, as estimated by the Central Water Commission in its reports of October 2001 and March, 2003 and, therefore, there would be no injury or loss to the State of Goa, if the interim relief, as prayed for, were to be granted.

(v) It was pleaded by the applicant State that even with regard to future claims of the State of Goa, which is up to the year

2051, as stated in the Master Plan, the requirement is 94.4 tmc, and in the event of the State of Goa succeeding in establishing its claim before the Tribunal, and even if the total water available in Mahadayi basin is considered at 108.72 tmc, there would be no loss or injury if the State of Karnataka was permitted to lift 7 tmc of water, in view of the extreme drought situation, which were likely to persist in the future.

The applicant State of Karnataka had mentioned that to the extent of 108.72 tmc there was no lis

or dispute between the party States before the Tribunal, and therefore, the Tribunal should pass an interim order in favour of the applicant State of Karnataka.

(vi) It was further pleaded in the application that an aggregate quantity of 7 tmc of water annually for lifting from river Mahadayi basin at points X-Y (1.5 tmc); X1-Y1 (5.5 tmc which includes 4 tmc to be lifted at X2-Y2) to Malaprabha River, was proposed by the applicant State of Karnataka, as identified on the Map appended to the Preliminary Report titled “Temporary Lifting of 7 tmc of water from Mahadayi Basin to Malaprabha Basin”

(vii) Various other details were mentioned and pleas taken, by the State of Karnataka, in the said IA. By and large, the aforesaid pleas were having the tenor and were in the direction of the stand which has been taken by the State of

Karnataka, in its Statement of Claim dated 02.01.2013, (Vol. 10) and also Karnataka's Reply, dated 18.03.2013, (Vol. 33), to the Statement of Case filed by Goa, and further pleadings filed by the State of Karnataka, at different stages of

324

proceedings,

either

by

way

of

amendments

or

replies/rejoinders to the opposite States.

(viii)

It was further pleaded by the applicant State that even as per weekly reservoir storage bulletin issued by the Central Water Commission, the yield storage at Malaprabha basin, as on 05.11.2015, was only 28% as against the live storage capacity of 34.346 tmc representing shortage of 72% and, therefore, the prayer made in the application should be granted as the shortage has adversely affected the irrigation, drinking water needs etc.

(ix)

The said I.A. 60 of 2015, filed by Karnataka was vehemently

contested by the State of Goa. It was maintained that the said IA had been filed belatedly and with gross delay and latches and, therefore, the same was liable to be dismissed. It was also stated that the application was thoroughly misconceived and based on inflated, concocted and artificially flavoured alleged demands. Having emphasised that a party coming to the Tribunal for interim relief is required to plead, aver and prove the three mandatory predicates of having a prima facie case, balance of

convenience and irreparable loss, it was stated in the reply that the State of Karnataka had neither pleaded nor averred, leave alone adduced any proof, whatsoever, of any of these three predicates, and as the entire application was based on the public agitation, which was said to be patronised by its functionaries and politicians, and on the alleged word ‘drought’, as if it was a word of magic to secure returns without even mentioning or making necessary averments, the application would be liable to be dismissed.

(x)

The State of Goa in reply claimed that the State of Karnataka had failed to state as to what kind of drought, as alleged, was being experienced by the said State, because there are various types of droughts such as meteorological drought, on account of lack of precipitations, agricultural drought on account of lack of moisture in the soil where crops grow, hydrological drought on account of low level of waters in reservoirs and aquifers. According to the State

of Goa

droughts are normally declared by the

meteorologists, based on precipitation patterns, stream

flow and moisture of soil, only for a long period of time, but

the State of Karnataka had not even mentioned, nor any of the documents produced by it, to indicate even remotely as to what kind of drought was being faced by the said State.

(xi)

According to Goa, the water scarcity i.e. hydrological drought, is most acute in the regions where there is a lot of sugarcane plantation, and the most prominent of these areas are in Maharashtra, and on Karnataka's own admission it appeared that the same are in the Hubli-Dharwad region also.

(xii)

The State of Goa had pleaded that in the case of Hubli-Dharwad region, there is a complete mismanagement of available surface and ground water resources coupled with faulty planning, as well as misuse of water, which has resulted in creation of hydrological drought, which is something

completely

different

and

distinct

from

hydrological drought in other parts of the country, wherein

drought is only on account of meteorological reasons.

(xiii)

In the reply it was maintained that the general drought

management concept is that if the ground water is

managed wisely, even then in a year when the rainfall is inadequate and there is considerable diminished availability of water from surplus sources, there still would be adequate amount of ground water available, and the people would not have to face severe water scarcity.

It was asserted that the said application was silent on the ground water management, and by bringing large areas under sugarcane cultivation, the aquifer has been pumped dry.

(xiv)

The State of Goa had made a reference to the report of the Directorate of Sugarcane Development, Government of India (Ministry of Agriculture and Farmers Welfare, Department of Agriculture Cooperation and Farmers Welfare) and maintained that the sugarcane plantation in the Districts of Belgaum and Dharwad for the year 2011-12 was reported to be 1,78,000 Ha and 3,470 Ha, respectively, which amounted to the total area of 1,81,470 Ha and,

therefore, in order to cater

sugarcane plantation in

area,

the

total

to the water required for

and Dharwad

the Belgaum

water requirement for sugarcane

cultivation for the said area would come to nearly 160 tmc,

and water in such large quantities is not likely to be available from surface sources.

(xv)

The State of Goa had further referred to a study carried out by the Norweign Institute for Water Research, which is an Institute in the Environmental Research, titled as "Hydrology and Water Location in Malaprabha" and asserted that 50% of the severity of the drought could be reduced by reducing the area under sugarcane cultivation by 56%.

(xvi)

The State of Goa had Specifically mentioned that the requirement of water, and the demand, of the State are much more than the mere requirement of 94.42 tmc,

because there are navigational channels in the Cumbarjua Canal, connecting the Mahadayi river to Zuari river, and connecting Mormugoa Port and other ports, including the Panaji Port etc., wherein a particular draft is required for the vessels entering in Mahadayi river and in the event of any kind of aberration, whatsoever, by the upstream State of Karnataka, or State of Maharashtra, the level of water in the river would get depleted, and this would result into

lesser draft in the water level in Mahadayi river, thereby creating obstructions, to navigation within the Mandovi river, which activities are of utmost necessity and for the economic and socio-ecological reasons of the State and its people.

(xvii)

According to the State of Goa, in the year 2015-16, and even later on, the water level continued to be below required level, whereas so far as Anjunem Dam is concerned, it was below the Full Reservoir Level, and at Ganjem the water level having gone down that year, the drinking water scheme project which pumps water from Mahadayi into Khandepar river had become dysfunctional, on account of low level, and the State of Goa had to resort to taking water from the surrounding areas,

and put the water pumped from the mining pits in Khandepar river, so as to resolve the acute drinking water shortage in the State.

(xviii)

The State of Goa had mentioned that the claim of the State of Karnataka that the Districts of Hubli-Dharwad were reeling under water severity was difficult to accept for the

simple reason that the PepsiCo unit in Dharwad is being supplied with four lakh litres of Malaprabha water per day, which would satisfy the house-hold domestic requirements of at least 16,000 people, but no steps had been taken to reduce the quantity of water being supplied to PepsiCo's Dharwad unit.

(xix)

The State of Goa asserted that the State of Karnataka was planning/soliciting proposals to set up various industries in the industrial sector of Hubli-Dharwad region, and as reported in the web site of the Ministry of Micro, Small & Medium Enterprises, the State of Karnataka had 345 factories in the Dharwad District, as on 31.03.2009, whereas the proposed industrial area in Dharwad district is in 3306.19 Ha, out of which 2314.73 Ha of land had been developed for industrial sectors, and to set up huge industries, despite the alleged claims of water scarcity.

(xx)

According to Goa, the extent of areas shown for sugar cane

cultivation had multiplied several times than what it was earlier, using the entire water for the purpose of cultivating a water guzzling crop such as sugar cane. It was also

mentioned that the State of
Karnataka
had failed in its
approach of conceiving, as well as planning, and thereby had created an artificial shortage of water by faulty planning and mismanagement of the available water resources.

(xxi)

One of the important facts pointed out by the State of Goa in its Reply was that the State of Karnataka had proposed to carry out such a massive project by constructing ducts and canals, under-ground tunnels by changing the topography, landscaping and cutting down trees, that too through a sanctuary, without obtaining any permission, either under the provisions of the Environment Act, 1986, or the Wild Life Protection Act, 1972, or any other relevant law and, therefore, the application should not be entertained. After having pointed out the fact that the State of Karnataka was a party to the judgement and order of the Supreme Court of

India, which required that prior to undertaking and carrying out of any project on an Inter-State river, a State is required to obtain prior permission of the Central Government and Planning Commission, it was stated that no such permissions had been obtained by Karnataka at all.

(xxii)

It was further pointed out that the State of Karnataka had disregarded provisions of the Environment Protection Act, Bio-Diversity Act, Bio Diversity Convention, The Forest Conservation Act, The Wildlife Act, and several other laws and regulations, and had undertaken and carried out the massive construction and was now seeking to divert the river from a deficient basin to a surplus basin, which is not permissible at all.

(xxiii)

Besides the defences, which have been noticed in the above paragraphs, the State of Goa, took many other

pleas/objections, which were on the lines and tenor of the pleas which it had raised in its Statement of Case, (originally filed or amended later on). Therefore, it would not be necessary to notice the same at this stage.

(xxiv)

A rejoinder was also filed by the State of Karnataka, in which the various pleas raised by the State of Goa were controverted and the pleas raised by Karnataka in the interim application were reiterated.

(xxv)

The State of Goa chose to file a sur-rejoinder. A reference was made to the contention raised in original statement of

claim filed by the State of Karnataka on 2.1.2013, (Volume 10), and attention of the Tribunal was drawn to the conte ntion raised at Page 85, to the effect that “therefore, the entire projected water requirement of Goa that includes the total planned uses of 94.40 tmc (which is totally unrealistic and unjustified) and the environmental needs of 6.50 tmc comes to about 100.90 tmc annually (not admitted)” to emphasise that on the admission of the State of Karnataka, it was apparent that the figure 94.40 tmc, does not include requirement of water for environmental needs.

Having asserted that the State of Goa had not admitted that the total requirement of the State of Goa was limited only to 94.42 tmc, or that there was an alleged surplus of 7.94 tmc, it was pleaded that the demand of State of Goa, particularly of environmental needs, were present day requirements and therefore, lifting of 7 tmc should not be permitted.

39.

Vide a detailed Order dated 27.07.2016, the aforesaid I. A. No. 60 of 2015, along with the ancillary I.A. No. 66 of 2016, were dismissed. In these circumstances, the pleas, in support of

the diversion channel of Kalasa-Bhandura, and counter pleas opposing the said construction and other activities for execution of the aforesaid project, by the State of Karnataka and State of Goa, respectively, would not be necessary to be noticed here.

40.

However, some more pleas raised by the State of Goa, which would also be relevant, have been culled out from pleadings, which require to be noticed are as under:-

(a) The State of Goa asserts that the Apex Court has ruled that though the waters of an interstate river pass through the territories of the riparian States such waters cannot be said to be located in any one State.

(b) It is stated that “Mahadayi” river is in a state of flow and under no circumstances can Karnataka claim exclusive ownership or right to divert any part of the water so as to deprive Goa of its equitable share to meet its reasonable uses. What is asserted is that any project undertaken or likely to be undertaken by an upper riparian State may/will prejudice the rights of the lower riparian states and affect

the available water flow of Inter-State River and hence the

need for concurrence of other riparian States is to be obtained before taking River. It is stated and submitted that Small Rivulet at its Basin in the State of Karnataka is less than 0.20% of the total area of the State of Karnataka and in contrast, Madei River is virtually the lifeline in so far as the State of Goa is concerned. It is maintained that the Madei basin in so far as the State of Goa is concerned, constitutes 42.70% of the total area of the State of Goa and taking into consideration such perspective, it is submitted that urgent Interim Orders are imperative in order to prevent the State of Karnataka from presenting “fait accompli” and further, from heaping upon the State of Goa disastrous

consequences.

(c) It is pleaded that Maharashtra's project proposals in Mahadayi Basin are also causing similar prejudices and disastrous consequences to Goa as the said projects are also planned in a manner affecting the downstream flow in River Valvanti, a tributary of River Mahadayi. As stated elsewhere in this submission, Maharashtra's original plan of constructing a dam across River Valvanti designed as water conservation structure to store monsoon flow with arrangement to release water to downstream Goa region

during lean season to keep the lean season flow to Goa's region of Mahadayi River was acceptable. It would have caused an additional prejudice to Karnataka's planning of damming Haltar Nallah at its origin and to annex the water shed at the upstream portion of the dam to Krishna basin as has been in progress in Kalsa Nalla.

It is pointed out that however, State of Maharashtra on its own volition and without discussion and consent of Goa had shifted the dam alignment to Katika Nalla, a sub – tributary of Haltar Nalla and even started speaking the language of defiant Karnataka that there is no consent of the lower riparian State or environmental impact assessment is required for constructing water retention structure in a tributary even if it is of an interstate river.

(d) State of Goa submits that the State of Karnataka has not carried out any Dam Break Study or Dam Break Analysis for any of the proposed Kalsa Dam, Haltara Dam, Bhandura Dam, Kotni Dam and Irti Dam and it is therefore apparent that the State of Karnataka is seeking to go ahead with the

construction of the aforesaid Dams without paying any heed to the safety aspects of the people residing in the

downstream areas of the said Dams, including the human and wildlife population within the State of Goa.

(e) The State of Goa asserts that it has a very high dependency on water related economy based on tourism, fishing, agriculture, forest, flora and fauna, navigation, inland water ways, transportation through barges for the purposes of mineral ore, loading and unloading from various areas in Goa at jetty points to Mormugoa Harbour to Panaji Port, all of which is through the navigational channels in the Mhadei basin. Consequently, any change in the water resource/abstraction/diversion of any kind whatsoever will have disastrous impact not only on the economy, ecology but also on the entire river basin itself.

(f)

The state of Goa submits that any use, utilization of water, construction of project, diversion in any river by any person, authority or state is subject to the provisions of the constitution of India and more particularly fundamental rights contained in the Constitution of India. It is pointed out that the state of Karnataka does not have any right, to breach the constitutional provisions in their attempt to divert the water flow from the Mhadei River. Any such

action is curtailed and subject to the constitutional provisions.

(g) The state of Goa submits that the state of Karnataka cannot breach or violate the fundamental rights guaranteed under article 14, article 19(1)(g) of the constitution of India upon the citizens residing in the state of Goa and more particularly Mhadei basin whereas the state of Goa is bound to respect and protect the rights of the citizens in the Mhadei basin and the state of Goa.

It is emphasized that the high-handed action on the part of the state of Karnataka to commence construction and attempt diversion of water from river Mhadei is in direct breach of the fundamental rights of the people of Goa and the inhabitants of Mhadei basin.

(h) It is stressed that there is complete breach of article 14 of the constitution of India and the manner in which the state of Karnataka has acted and conducted itself shows complete disregard to the rule of law which is a facet of Article 14 of the Constitution of India. It is mentioned that the entire

project has been started by the state of Karnataka without any permission from any of the statutory authorities including authorities under the environment protection Act,

339

Wildlife Protection Act, Forest Act etc., and the untoward hurry and haste which the state of Karnataka has shown in commencing the work at the site without any study and impact on the environment, ecology and people in the Mhadei basin itself shows highhandedness, arbitrariness and unreasonableness which is in gross violation article 14 of the constitution of India.

(i)

It is asserted that the proposed actions would subject the population to poverty and penury and the source of earning of the people would be completely destroyed as there would be disastrous effect on the agriculture, fishery, etc. Thus, it is demonstrated that there is direct infringement on the fundamental rights conferred under article 19(1)(g) of the constitution of India.

The state of Goa submits that the standard of living in terms of ecology, fresh air, fresh water, is a facet of Article 21 of the Constitution of India and the action of the state of Karnataka

would

destroy

environment,

ecology,

by

destruction of forest, wildlife, flora and fauna etc., which

would therefore directly infringe the lives of people of Goa

and the Mhadei basin. Such actions are therefore in

complete infringement of Article 21 of the constitution of India.

(j)

The State of Goa submits that Article 48A enjoins the state to protect the environment, safeguard the forest and protect the wildlife, but the action of the state of Karnataka to divert/store, create dam, embankment or any abstraction of any kind whatsoever of the water from the Mhadei basin would certainly destroy the environment, forest and the wildlife as narrated herein above.

(k) The state of Goa submits that reliance placed by state of Karnataka on entry 17 of list II in the seventh schedule is completely misconceived and misplaced in facts and circumstances of the case. The state of Goa submits that “water” so referred to in Entry 17 in list II of the seventh schedule cannot be interpreted to such an extent that it would include an inter-state river within its ambit and in fact, the legislative field of the state Government is subject to the provision of Entry 56 of List I. It is submitted on behalf

of State of Goa, that in terms, entry 56 relate to the regulation and development of inter-State rivers and river valleys to which such regulation and development under the control of the union which is declared by the Parliament to

be expedient in public interest. The State of Goa states that the Parliament of India in terms of Entry 56 of List I of Seventh Schedule has already enacted a law namely Inter-State Water Disputes Act, 1956, wherein any dispute which is raised by the central Government in terms of Section 3 of the said Act, may be referred to the water dispute tribunal for its adjudication.

41.

In the light of the above pleas, noticed in detail in the above paragraphs, the State of Goa has sought reliefs, to which reference is made earlier.

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - III

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – III

Sl. No.	DESCRIPTION	PAGE NOS
1.	Pleadings of the State of Karnataka	342 - 487
2.	Pleadings of the State of Maharashtra	
3.	Re-framing/Re-casting of Issues vide Order dated 17.07.2015. Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.	

488 - 525

525 - 543

4.

544 - 586

342

DETAILED PLEADINGS OF THE STATE OF KARNATAKA

42.

After having noticed the pleadings of the State of Goa in detail, as mentioned above, it would now be appropriate to detail the pleadings of the State of Karnataka as emerging from:- (1) Statement of Claims filed by the State of Karnataka on January 2013 (Volume 10); (2) Rejoinder dated July 15, 2013 (Volume 46) filed by the State of Karnataka to the reply dated May 10, 2013 filed by the State of Goa on May 14, 2013; (3) Rejoinder dated July 15, 2013 (Volume 47) filed by the State of Karnataka to the reply dated May 15, 2013 filed by the State of Maharashtra; (4) Amended Statement of Claims filed by the State of Karnataka dated February 24, 2015 (Volume 129); (5) Full Rejoinder dated June, 24, 2015 (Volume 144) filed by the State of Karnataka to the replies dated May 14, 2015 and May 5, 2015 filed by the State of Goa to the Statement of Claims of the State of Karnataka dated January 2, 2013; (6) Rejoinder dated June 24, 2015 (Volume 142) filed by the State of Karnataka to the reply dated April 29, 2015 of the State of Maharashtra to the amended

Statement of Claims of the State of Karnataka; as under:-

343

(i)

The State of Karnataka has submitted the Statement of Claims under the following headings:

a.

b.

c.

d.

Case of the State of Karnataka

Facts, data and documents

Propositions of law

Reliefs

(ii)

Karnataka states that, before dealing with the matter under the above headings, a brief background note of the disputes and how and why they arose would be necessary for an overall understanding of the case.

(iii)

<u>Points to be considered in the background note are:</u>

A.

B.

C.

Negotiations

Construction of ongoing Kalasa Bhandura Project

Effect of deletion of paras 28(iv) and 28(v) from Goa's

complaint dated 09.07.2002; and

D.

Effect of final judgment dated 20.01.2011 in the original suit

No. 4/2006 by the Supreme Court of India.

344

(A)

Negotiations:

(i)

Plans for utilisation of the waters of the Inter State River Mahadayi in the State of Karnataka (hereafter Karnataka) started in the mid 1980's. In the beginning, Karnataka explored Hydro Electric Project for 350 MW. Pursuing the proposal, on 16.03.1989, the · then Chief Minister of Karnataka wrote to his counterpart of the State of Goa (hereafter Goa) inter alia as follows:

“As you know the Karn ataka Power Corporation has taken up the Mahadayi Hydro Electric Project in Khanapur Taluk. This project with an installed capacity of 350 MW is economically viable and would be a most welcome addition to our electricity generating capacity. I am grateful to you for agreeing to our taking up and going ahead with this project.

As discussed yesterday we will be using 50%

of the water from Mahadayi river for irrigation purposes in Karnataka. Even after utilizing the water for irrigation purposes in Karnataka/ there would be a continuous flow of water from storage dam of the power project. This can very well serve the purposes of drinking water and irrigation in Goa throughout the year."

345

(ii)

Subsequently, an Inter State meeting was held on 02.07.1992 to discuss the sharing of the waters of Inter State River Mahadayi. In the said meeting, Karnataka proposed 29 tmc for generation purpose as well as for diversion to Malaprabha river.

Out of the 29 tmc,

Karnataka proposed to divert 9 tmc to Malaprabha. Karnataka indicated that Goa would be benefited with continuous flow of 1 tmc per month in the post monsoon periods and that there would be no adverse effects on the downstream riparian State of Goa. Goa stated that it opposed the project for various reasons. The said interstate meeting dated 02.07.1992 resolved to constitute a Technical Committee (hereafter TC) of the officers of both the States to examine the projects.

(iii) When Karnataka submitted an environmental impact assessment (EIA) study of its hydro-electric project prepared by the Institute of Command Studies and

Irrigation Management (ICSIM) in the second meeting of TC held on 27.09.1993, Goa stated that the said EIA study prepared by Karnataka "does not deal with EIA of Goa State due to the Proposed project" and then suggested that "a

separate EIA report should be got worked out with reference to Goa" as recordedin the minutes.

(iv)

Accordingly, a third meeting of the TC was held on 02.09.1994, where it was Inter alia decided to approach National Environmental Engineering Research Institute (NEERI) - a public institute at the national level to "undertake EIA studies in Goa region with respect to the parameters lis ted in the annexure". The said annexure is an enclosure to the minutes of the meeting dated 02.09.1994, which inter-alia states that:

"Assessment of the impact of projected increase in the total fresh water now in the river system of Goa, due to Mahadayi project during the dry months on the "Ecology/Environment" ... "

(v)

The terms of reference to carryout EIA studies finalized by the Technical Committee in the above meeting held on 2.9.1994 were approved by the Government of Goa as

communicated in the letter dated 25.01.1995 sent by the Superintending Engineer and Convener of the Technical Committee, Goa which is extracted below:

347

" The Govt. of Goa has no objection in requesting NEER! to the EI.A./ as it is a premier Govt. of India Institution in environmental Engineering. They could also take the help of NIO in so far as the Impact of this on ocean bed as the estuary area of the river has to be assessed'.

(vi)

During the pendency of the NEERI study, a meeting was held on 10.9.1996 between the Irrigation Ministers of Goa and Karnataka respectively and an understanding was reached on the construction of Kalasa Nala Dam to divert 3.34 tmc from Kalasa Nala to Malaprabha record of the Minutes is as follows:

River. The

"In the first instance, the Hon’ble Irrigation Minister of Karnataka gave a brief regarding diversion of Mahadayiriver to Malaprabha River. The Mahadayi Multipurpose Irrigation Project consists of the following three

components:

a)

Construction of Kotni dam for power generation and diversion of 4 tmc of water to Malaprabha river.

Construction of Kalasa Nala dam to divert 3.34 tmc of water to Malaprabha River.

b)

c)

Construction of Haltar and Potli dams for diversion of 0.56 tmc and 1.10 tmc respectively to Malaprabha River.

The features of the above projects are as follows:

CONSTRUCTION OF KOTNI DAM

The NEERI Nagpur has been entrusted with the study of EIA on the Ecology of Goa region. The draft rapid interim report has been received recently. The final report is expected during November 1996. During the meeting/ it has been pointed out that NEERI Nagpur should consult N.I.O. Goa and finalized the EI.A. Report. Taking up of this project the pros & cons were discussed by both the Governments in length and concluded that the decision may be taken up only after the receipt of final report from the NEERI Nagpur.

CONSTRUCTION OF KALASA NALA DAM

The Irrigation Secretary Karnataka high-lighted

the Government of project details regarding utilisation of water and other benefits to both the Governments. The Karnataka Government is interested to divert 3.34 tmc from Kalasa Nala to Malaprabha River. On discussion of this issue, both the Governments have consented for this project subject to making availability of 1.50 tmc of water required for the "Mandovi Project", proposed on the downstream of Kalasa Nala for irrigation, so also for drinking water requirements of Goa State.

349

CONSTRUCTION OF HALTAR AND POTLI DAMS

These will be taken up separately, as these involves three States viz., Goa, Karnataka and Maharashtra.

The Irrigation Minister of Goa and Karnataka have opined that, the Chief Engineers of both the Governments should discuss this issue and arrive at technical feasibility of Kalasa Nala dam. The technical feasibility report should be finalized by the end of September 1996. Based on technical report, a meeting between the Chief Ministers of Government of Karnataka and Goa may be arranged in the first week of October 1996 to finalize the issues."

vii)

The NEERI submitted its report in September, 1997 which was sent to Goa by letter dated 06.04.1998. The said Report duly examined the scope of the project, baseline status of the environment, identification of impacts and prediction of impacts on the environment due to the construction of

Mahadayi Hydro Electric project and it has also furnished in the report an Environmental Impact Statement.

viii) According to Karnataka, NEERI considered the then proposed hydro-electric project at Kotni by the KPCL - an Undertaking of the Government of Karnataka. The

envisaged diversion from Mahadayi hydro-electric project from the periphery of Kotni reservoir was 113 Mcum (4.00 tmc) to Malaprabha river for augmenting the available flows. In addition, 142 Mcum (5.00 tmc) of water was proposed to be diverted from Kalsa, Haltar and Potli nalas to the Malaprabha sub basin. The NEERI considered 9.00 tmc of diversion in addition to the utilisation under Mahadayi HEP in its report of EIA. The NEERI considered total yield of the Mahadayi in Karnataka as 1082 Mcum (38.21 tmc). Based on the preliminary water balance study of Mahadayi basin conducted by the National Water Development Agency (NWDA) in July 1989, NEERI has worked out the yield in the Mahadayi basin (after excluding salt water zone) for the pre, and post, construction scenarios in Table 3.5 which has been graphically depicted in figure 3.2. NEERI has also given the annual yield of Mahadayi basin as measured at Ganjim and Collem at Table 3.6 for six years viz., 1980-81, 1981-82, 1982-83, 1983-84, 1984-85 and 1985-86.

ix)

According to NEERI - "The yield available in Goa after construction of reservoirs in Karnataka is 92. 61 % of

average flow during monsoon (June-October) 251.29% during non-monsoon (November-May) and 94.59% during June-May. With only 2% of yield being utilized in the form of diversion and evaporation, the balance 98% will be put back in the river in a regulated manner during the operation of the project." (see para 3.4.2 of the NEERI Report). Karnataka submits that the scenario projected in Table 3.5 with a graphic representation in Figure 3.2 will not materially change, if the proposed consumptive utilisation of 24.15 tmc in Karnataka is considered.

x)

Accordingly, Karnataka maintains that the proposed consumption of 24.15 tmc of Mahadayi water in its territory would not prejudicially affect the interests of the State of Goa or its inhabitants in any manner.

xi)

Karnataka maintains, by reproducing the relevant contents of the Report, that NEERI considered impacts of the then proposed diversion of 9.00 tmc of Mahadayi water in

Karnataka on the river hydrology and ecology, in Chapter 6 of its report. Due to the then proposed hydro-power project

with a diversion of 9.00 tmc to Malaprabha basin, NEERI, inter-alia, found that:

"The process of sand bar formation and other associated phenomenon in Goa including the navigability of the river will remain unaffected."

(Para 6.2.3 at page 6-10 volume I)

"...the change in salinity values along the various channels is marginal during the pre, and post, project scenario for both extreme situations obtained in summer and monsoon seasons."

(Para 6.3.2 at page 6-24 volume I)

"Presently, the Mahadayi River in Karnataka is a small shallow river while its tributaries and other nalas are seasonal water bodies with less flow of water except in monsoon season. In the absence of proper planning for harvesting of the valuable water resource most of the water flows to the sea. Construction of dam(s) would be helpful in conservation of water and recharge · of ground

water, thereby, creating a positive impact on the vegetation. Kalsa and Sur/a nala area has moist deciduous forest which is a degraded forest. The quality of this forest would be improved through water conservation by the construction of dam(s) on the river."

353

(para 6.4.2 at page 6-32 volume I)

"The marginally changed stream flow would not have pronounced effect on the downstream flora and fauna. The mangrove vegetation has a wide tolerance for salinity, and through proper management their growth can be enhanced to suit marginal change in the flow pattern."

(para 6.4.2 at page 6-32 volume I)

"In case of change of salinity in certain stretches of Mandovi river during the post project phase/ the organisms which can move fast (e.g. fish) will migrate to adjacent stretches having favourable salinity for the inhabited fauna. Thus the fauna will be redistributed within certain stretches of the river, and there will not be any loss or reduction of species diversity. The elimination of fauna from one stretch will be compensated by recolonization of the fauna from the adjacent stretch of the river."

(para 6.4.2 at page 6-33 volume I)

"Slight changes in river now between monsoon and non-monsoon seasons will not have any influence on soil salinity of the Khazan land. However, the prediction of water salinity changes indicate a lowering of salinity in the Mandovi estuary which is beneficial to Khazan paddy cultivation."

(para 6.5 at page 6-41 volume I)

(xii) Karnataka has referred to, and reproduced, the NEERI Report conclusions as follows: The NEERI report, inter alia, concluded as follows:

"14. Under critical summer conditions, the post project flows in the Mahadayi/Mandovi will not alter the salinity upstream of Usgaon Pali and downstream of Amone village. However, there will be a marginal reduction in salinity in the stretch between Usgaon Pali and Amone village. During monsoon season, the pre, and post, project scenario in the flow conditions remain unaltered.

15. The post-project flows in river Mandovi may bring about a temporary change in the distribution of flora and fauna of the estuarine system. They are likely to be redistributed in the stretch of salinity variation. The stretch between Usgaon and Amone may sometimes become biologically more productive due to colonization of new life forms from the adjacent

habitats.

16. Due to the post project change in the flow regime of the Mahadayi/Mandovi, no significant impact on the phenomenon of sand bar formation at the mouth of the river, the associated navigational activities and the beach ecosystem of Goa is anticipated.

17. Due to the construction of dams and impoundage of water, the flood peaks in river Mandovi will get moderated. The river flows during post monsoon

would remain practically unaltered, while in summer the flows will not be that high as to cause floods and scouring of the river bed.

18. The water requirements for various uses in Goa state will be met effectively since additional flow will be available in the river during non-monsoon (November May) period.

19. The predicted impact of salinity changes in the estuaries portion of the river Mandovi in Goa being marginal, the associated impact on Khazan paddy cultivation and on the mangroves of Goa will not be significant."

xiii) Karnataka maintains that the present proposed consumption of 24.15 tmc of Mahadayi water in Karnataka

would not affect the findings or conclusions of the NEERI, which was based on the then proposed diversion of 9.00 tmc of Mahadayi water in Karnataka. The change in the water regime calculated by Karnataka are almost the same as the change in the water regime as considered by NEERI.

xiv) Karnataka points out that after the NEERI report was forwarded to Goa, an Inter-State meeting was held on 25.04.1998. In that meeting, it was decided as follows:

"1) After detailed discussion it was decided to constitute a Committee to study the technical feasibility of Joint Venture Projects of Kalasa and Haltara. The Committee is to submit the report within three months.

2) The detailed report submitted by the NEERI will be referred to the High-Power Committee Constituted by Goa Government and the report of the Committee is to be submitted to Goa Government within six months."

Karnataka states that it was neither informed at any time, whether the High-Power Committee submitted a Report to the Government of Goa, nor made aware of the contents of any such Report.

xv)

Karnataka points out that the State of Goa communicated its objections to the NEERI studies vide a communication dated 06.07.1998. According to Goa, "the studies by NEERI seem to be based on the use of highly unreliable

hydrological data and therefore, the conclusions drawn by them also seem vitiated"

xvi) In the said communication dated 06.07.1998, Goa sought certain clarifications, and attempted to suggest that "all

conclusions drawn by NEERI regarding yield available in Goa pre-and post-construction stage of Karnataka projects are in error."

According to Karnataka through another letter dated 25.01.1999, Goa crystallized its objections against the NEERI report by stating that the question to be considered is - "Whether basic hydrological data supplied to NEERI is correct and complete".

Various other objections were also raised by Goa against the NEERI Report. All these objections were replied by Karnataka and were stated to have denied.

xvii) Karnataka points out to a further letter

dated

13/18.04.2000, whereby the Chief Minister of Goa had reiterated the contentions against NEERI report that "it is based on incorrect hydrological data”. Goa also stated that "no valid reason is given for not a ssociating the NIO.” Goa also stated in the letter that - "When my officers had pointed out the deficiencies in the water balance studies carried out by NWDA, the NWDA have agreed to revise their water balance studies. Hence, the E.I.A. studies will

have to be reviewed after the NWDA revises water balance study and correct hydrological data are made available."

Karnataka points out to another letter from Goa dated 19.02.2001, inter alia, stating that:

"EIA by NEERI could be only after there is an agreement between the two states on the basis of hydrological data. NEERI or NWDA cannot be left to be the final arbiters of this correct hydrological data. Even the basic hydrological parameters such as rainfall at a station for particular years differ from document to document. This has to be first reconciled and an agreed data base has to be evolved by the two States."

xviii) According to Karnataka Goa raised unjustifiable objections against the NEERI report: having agreed to the terms of reference of the study as detailed in the annexure to the Minutes of the third TC Meeting held on 02.09.1994 read with letter dated 25.01.1995, it was not and is not open to

Goa to object to the NEERI study by stating that: "EIA by NEERI could be only after there is an agreement between the two states on the basis of hydrological data.”

Karnataka maintains that when studies were referred to the NEERI as per the understanding in the Inter-State meeting held on 02.09.1994, no such condition was insisted on by Goa. Even during the study conducted by NEERI, Goa did not object to the consideration of NWDA yield studies. Therefore, the objections of Goa against the NEERI report are an afterthought.

After wrongly rejecting the NEERI study as an over estimation, Goa made a fresh demand for hydrological studies of the Mahadayi basin.

xix) An Inter-State meeting was convened on 29.05.2001 by the Member (WP & P), CWC, to discuss the gravity of the Inter-State problem. The meeting was attended by the Secretaries of the Irrigation Departments of Governments of Goa, Karnataka and Maharashtra, respectively, and the representatives of the NWDA and at the meeting it was decided that the yield study of the Mahadayi basin would be carried out by a Committee under the Chairmanship of the Chief Engineer (Hydrological studies) of the CWC having

representatives from the three States and NWDA.

360

xx)

Karnataka has referred to the minutes of the meeting, held on 29.05.2001, recorded as follows:

"2.5 Chairman requested Govt. of Karnataka not to take up the works, pending completion of studies/clearance from central agencies.

2.6 After discussions the following decisions were taken up:

(i) A hydrological study group under the Chairmanship of Chief Engineer (Hydrological Studies), CWC; New Delhi with representatives of NWDA and three States Govt will carry out the hydrological studies for assessment of yield of the Madei/Mandovi River. The following officers would represent the three State Governments:

1.

Shri Shivarudrappa, EE, WRDO,

Govt. of Karnataka

Shri Radha Krishna, A.E, KPCL,

Govt. of Karnataka

Shri S.D. Sayanak, Chief Engineer,

Govt. of Goa.

Shri Kott Chief Engineer (Hydrology),

Govt. of Maharashtra.

2.

3.

4.

(ii) The hydrological study group would submit its report within three months."

The Government of Karnataka was requested not to take up the works pending completion of studies on yield by the CWC.

xxi) According to Karnataka, the CWC, thereafter, conducted the Hydrological studies (i.e. yield studies) and submitted the same for consideration of the States in October 2001.

xxii) Karnataka has asserted that pursuant to the decision taken at the meeting dated 29.05.2001, to study the yield of Mahadayi basin under the Chairmanship of the Chief· Engineer (Hydrology Study Organisation), CWC, with representatives from the three States, studies were duly carried out as aforesaid. The report of the yield studies by the CWC could not, then, be once again questioned by Goa. Thereafter, the Government of Karnataka on 30.03.2002, requested the Union Ministry of Water Resources for clearance of the schemes namely Kalasa-Bhanduri project for diversion of only 7.56 tmc of Mahadayi water to

Malaprabha river to meet the drinking water requirements to Hubli-Dharwad cities.

xxiii) Karnataka refers to the request it made to Government of India, based on the said CWC report, through its letter dated 30.03.2002, for clearance stating, inter alia, as follows:

"The Mahadayi river basin has got a total catchment area of 2032 sq. kms out of which 412 sq.km. lie in Karnataka up to State border. The basin receives very heavy rainfall in the catchment of Karnataka during the south-west monsoon period. As per the Central Water Commission study done recently during October 2001 the yield of the basin is assessed to vary between 180 tmc to 220 tmc at 75% dependability. The yield from Karnataka portion of catchment is estimated to be about 45 tmc based on actual gauging at Ganjim by Central Water Commission."

xxiv) An inter-state meeting was convened on 27.03.2002 under the aegis of the CWC inter alia to consider the proposal of Karnataka for the clearance of Kalasa and Bhandura project. The minutes recorded, inter alia, are as follows:

"3.0 Item No.2: Hydrological studies for assessment of yield of the Madei/Mandovi river

Chief Engineer (HSO), CWC briefly narrated the present status of yield studies carried out for Mahadayi basin and informed that in-spite of convening two meetings of the study group on 13.10.2001 and 11.1.2002/the yield studies could not be finalized. He particularly stated that Govt. of Goa is insisting on analysis of rainfall data including the period 1901-1931. Also, they have reservations about the accuracy of discharge data at CWC G & D site at Ganjim. Goa had also expressed the view that all the studies had to be carried out in the presence of their representatives.

Secretary, Govt. of Goa explaining the view point of Goa stated that the rainfall data for the year 1901 to 1931 have to be included because the above period consists of large consecutive

number of distress years. He also stated that Govt. of Goa should be informed about the period of data/ the method of analysis etc. well in advance so that they can convey their views. Director (Hydrology) CWC explained that out of the three stations considered during the year 1901-1931, only one station i.e., Panjim comes within the Mandovi basin and therefore considering all the three stations for purposes of runoff of Mandovi basin may not reflect the correct picture. Chief Engineer, Govt. of Goa stated the CWC discharge data at Ganjim is not

correct Chief Engineer (IMO) CWC refuting this, stated that it is wrong on part of the representative of Govt. of Goa to make such a statement and explained in detail the standard procedure adopted by CWC in collection analysis and processing of hydro-meteorological data. He further stated that in case of observational and other errors, necessary corrections are always carried out at the time of data processing. Chairman expressed his regret that Govt. of Goa has so many reservations on the yield studies and even on the data collected and utilised by an independent Expert agency viz. CWC. He indicated that if such doubts exist even in the work carried out by agencies like CWC perhaps the studies cannot progress. Chairman felt that under such circumstances, Govt. of Goa may themselves carry out this yield studies. It was therefore decided that CWC and NWDA

would supply all the hydrological and hydro-meteorological data collected and analyzed by them to Govt. of Goa for carrying out the yield studies. However, he emphasized that Govt. of Goa will have to stick to a reasonable time schedule. Secretary Water Resources, Govt. of Goa stated that three months period is necessary for completing the yield studies.

Secretary (WR), Government of Karnataka highlighted the drinking water problems in Hubli-Dharwar towns where water supply situation had become precarious due to falling ground water level and supply had become possible only once

in 10 days or so. He requested that clearance be given for diversion of 7.5 tmc from Madei to Malaprabha reservoir through Kalsa and Bandhuri nala diversion schemes for supplying drinking water to the twin towns.

Secretary (WR), Government of Goa stated that requirements of the Madei basin should be first met before considering outside diversion. He referred to the Krishna Water Tribunal Award in this context, where certain restrictions had been placed by the Tribunal on Maharashtra for diversion of Krishna waters outside the basin. He was of the view that Karnataka should examine other options like diversions from Kali to meet the shortage in Maharashtra. Since drinking water was the first charge, Government of Karnataka should curtail irrigation supplies at Malaprabha.

In response, Advisor, Government of

Karnataka stated that they had examined all options and the only technically and economically feasible solution was diversion by gravity from Madei.

Secretary(I), Government of Maharashtra referred to the KWDT Award as per which Government of Maharashtra has a right to stake a claim on any augmentation of Krishna waters by any of the Party States. He also expressed apprehension that Government of Karnataka might develop the capacity for higher diversion from Banduri nala and Kalsa once a storage scheme comes up. Government of Maharashtra

also reserved the right for diverting its share of Madei waters. Secretary, Government of Goa also expressed similar apprehensions about Government of Karnataka developing a capability for higher quantum of diversions. Commissioner (Projects) stated that placing restrictions on quantum of diversion was one thing but totally prohibiting any diversion was another. Both Krishna and Narmada Tribunals had placed no fetters on Andhra and MP/Gujarat/Maharashtra respectively on using their shares in any manner, they liked, including use in other basins. The grave situation in Hubli-Dharwar merited immediate attention. The diversion of 7.5 tmc proposed by Government of Karnataka could easily be adjusted in the share of that State whenever decided. As regards apprehension of Government of Maharashtra and Government of Goa about Government of

Karnataka developing capability for a higher diversion, he stated that the CWC could always check the technical parameters of the proposed diversion to remove such an apprehension. The three States could also consider setting up of River Basin Organisation for Madei which could inspect works of any of the States and also serve as a vehicle for free exchange of data among the States. According to him/ drinking water issues should not be delayed or deferred till the water sharing is decided.

On the request of Chairman, Secretary (WR) Government of Goa promised to take up the

request of Government of Karnataka with his
State Governments at appropriate level.
Chairman requested Govt. of Goa to finalize
the yield studies for Mandovi basin at the earliest
so that the developments in the basin is not
hampered and water does not flow waste to the
sea andimpressed upon the basin states to
frequently meet, and exchange requisite
information regarding the demands of the states
so that water resources of the region could be
used optimally by th e basin States".
According to Karnataka, the promise made by the
Secretary, Government of Goa at that meeting, to take the
request of Government of Karnataka with the State
Government of Goa at an appropriate level, was apparently
not responded to, since there was no communication by
the Secretary, Government of Goa to that effect.
xxv) Karnataka states that after waiting for more than a month
for Goa to submit its own yield studies, (which were never

submitted), the Union Ministry of Water Resources by letter dated 30.04.2002 conveyed its "in principle clearance from water availability angle" for diversion of 7.56 tmc. The relevant part of the letter is extracted below:

"In view of the above, in principle clearance from water availability angle is hereby conveyed to the Government of Karnataka for diversion of 7.56 tmc from Madei basin to meet the drinking water needs of Hubli/Dharwad subject to the following conditions:

a.

The quantity of 7.56 tmc will be diverted from monsoon flows and will be utilised only to meet drinking water needs of Hubli/Dharwad and will be adjusted against the share of Karnataka in Madei River Basin as and when finalised by the basin States of Goa, Maharashtra and Karnataka.

Government of Karnataka will furnish all required design details to enable the CWC to satisfy itself that Karnataka does not develop technical capability for diversion of more water (than as mentioned in para (a)

above) at a later stage.

Karnataka will permit and arrange site inspection for engineers/officials of the Central Water Commission, Government of Goa and Maharashtra, should they so desire to visit the site of works.

This approval is only from the water availability angle and Government of Karnataka shall follow the stipulated

b.

c.

d.

procedure for investment clearance of the
proposed drinking water scheme."

xxvi) Karnataka asserts that even till date, there have been no yield studies conducted by Goa, as agreed to by them. It is, thus, submitted that in the absence of yield studies conducted by or at the instance of the State of Goa, it is not open to Goa to question, any longer the yield studies done by an independent agency viz., the CWC.

xxvii) Karnataka vide letter dated 30.06.2010 (2nd July 2010) reminded Goa that - "We note that there is so far no disclosure of any document by the State of Goa in the pending suit with regard to yield studies. Please let us know whether the State of Goa is intending to rely on any yield study as mentioned in the minutes and if so, furnish a copy of such yield study. An early response is requested".

Goa responded through a letter dated 07.09.2010 and stated that:

"With respect to your letter referred above
please note that State of Goa has filed Civil Suit

No.4/2006 before the Hon'ble Supreme Court of India challenging the attempts of Government of

Karnataka to illegally divert water of Mahadai basin and seeking Constitution of interstate River Dispute Tribunal. Since the matter is sub-judice, you may raise whatever queries before the appropriate forum, where they will be dealt with in accordance with law"

xxviii) Karnataka states that at no stage, during the proceeding of the Suit (OS No.4 of 2006), the Government of Goa ever disclosed any document with regard to yield studies - either pursuant to the Central Water Commission's request or otherwise.

xxix) Wrongly claiming to be aggrieved against the grant of "in principle clearance" by the Union Ministry of Water Resources dated 30.04.2002, Goa lodged its protest and requested "withdrawal" of the said clearance. The protest was followed

by

a

series

of

correspondence and letters. However, in none of these letters, Goa had given any explanation as to why it has not conducted and submitted its studies at the earliest.

On 09.07.2002, Goa filed a Complaint under Sec.3 of the Inter State River Water Disputes Act, 1956 (Act of 1956), seeking constitution of a Tribunal to adjudicate the water

disputes with respect to Inter-State River Mahadayi, and its valley as mentioned therein Karnataka maintains that, according to Goa, the ‘in principle clearance’ was placed erroneously stated to be "... for the present in abeyance', since, the matter can now be resolved by an agreement between the two States, failing which by an award of the Tribunal". It was under these circumstances, that the Union of India stated in its letter dated 19.9.2002 that "there is no option left to the Ministry but to take steps under the Inter-State Water Disputes Act, 1956 for resolution of these disputes."

xxx) According to the State of Karnataka, the decision to keep "in abeyance" was not at all justified in law nor warranted, especially since the Goa Government, contrary to its own undertaking to the CWC to submit its own yield studies within three months, had, without any reason whatsoever, failed to do so.

It is submitted that clearance having been in conformity with existing water policy, which accorded priority to drinking water needs, the same could not have been kept in abeyance.

xxxi) A long drawn history of various correspondences and various meetings between Karnataka and Goa has been detailed by Karnataka in its pleadings, trying to emphasize that it was on account of not conducting an yield study by Goa, in spite of even an insistence in this regard by Government of India, which has resulted in the dispute remaining unresolved, it is not necessary to notice the aforesaid details at this stage, in as much as, in the year 2006, the matter had reached the Apex Court, by way of an Original Suit having been filed by Goa, having remained unresolved.

(B)

Construction of the ongoing Kalasa Bhandura Project

The State of Karnataka has given a detailed history of the State of Goa approaching the Supreme Court of India, by way of an Original Suit, with regard to the present dispute, as follows:

(i)

Goa filed an Original Suit being O.S.No.4 of 2006 in the

Hon'ble Supreme Court on 15.09.2006, inter alia,

seeking immediate constitution of a Tribunal under SECTION 4 of the Act of 1956 for adjudication of the water dispute arising out of the complaint of Goa of 09.07.2002 and also prayed that "MoWR should be directed to totally withdraw their 'in principle clearances' to Karnataka's projects in April 2002 and leave this matter to be decided by the Water Disputes Tribunal".

(ii)

An Interlocutory Application being I. A. No. 1 of 2006 was also moved in the said Suit stating that Karnataka "is going to commence on 2nd October, 2006" the Kalasa-Bhandhuri project. Goa prayed inter alia for an ad-interim restraint order against Karnataka as:

"...from proceeding with any planning construction and water regulation of any projects in the Mandovi river basin involving trans-basin diversion of waters until the Interstate disputes are adjudicated

by a Tribunal to be constituted by the 2nd defendant under the Inter State River Water Disputes Act, 1956'.

374

(iii) Karnataka had filed a caveat and thereafter filed a Counter Affidavit opposing the prayer for ad-interim orders. It was specifically stated in the said counter that:

"The Government of Karnataka will begin construction of the project on 2nd October 2006 in the non-forest areas out of non-plan funds i.e., State Funds - at its own risk and the diversion or utilization under this project would be subject to the outcome of the suit pending before this Hon'ble Court. Further, as submitted above, the Respondent State of Karnataka has no intention to utilize the waters actually - without obtaining the clearances under the provision of Environment Protection Act, 1986".

The State of Goa mentioned the matter before the Court on 28.09.2006 and prayed for ad-interim orders.

However, the Court did not pass any restraint order as prayed by Goa. The order is extracted below:

“Taken on board. Issue notice. Issue notice on the interim matter also. Place the matter on 1st October, 2006"

Karnataka, thus, maintains that, interim order, though expressly prayed for, was not granted by the Hon'ble Supreme Court.

(iv) According to the State of Karnataka, a State may unilaterally construct project on the Inter-State River, if there is no agreement or decision of the Tribunal prohibiting such construction, and as there were no impediments or restraint orders, the Government of Karnataka commenced the construction of the Kalasa-Bhandhuri project for diversion of 7.56 tmc of water on 02.10.2006, in the non-forest area but no diversion of any water has taken place.

(v)

Karnataka has stated that after the construction work of the Kalasa-Bhandhuri project started on 2nd October, 2006, the Union Minister for Environment and Forests, vide a letter dated 16.10.2006 wrote to the Chief Minister of Karnataka, inter alia, stating that:

"The above projects require both

environmental as well as forestry

clearances and my Ministry had in August,

2001 advised the Government of Karnataka to resubmit the proposals for the required statutory clearances after obtaining the views of the Central Water Commission. However, the State Government is yet to resubmit the proposals. I would therefore request you to advise the State Irrigation Department not to take up any work on the project without obtaining the statutory clearances".

However, the Chief Minister of Karnataka replied to the above letter, vide a letter 19.12.2006, justifying the construction, having regard to the urgent requirement of drinking water for Hubli-Dharwad twin cities and neighbouring areas and towns.

On 9th April, 2007, the Union Minister for Environment and Forests, replying to the said letter, advised the State

Governments to "resolve the dispute"

(vi)

Karnataka maintains that it had specifically stated in its counter affidavit dated 27.09.2006 filed in Original Suit O.S.No.4 of 2006 in the Supreme Court of India, that it has "no intention to utilize the waters actually -

without obtaining the clearances under the provision of Environment Protection Act, 1986".

Karnataka maintains that it had also reiterated its undertaking on 30.04.2008, when the Court passed the order by recording that "As per the statement made by the State of Karnataka in its counter affidavit filed on 27th September 2006, the State of Karnataka will not actually utilize the waters or divert the waters under the Kalasa Bhanduri project till next date of hearing"

(C)

Effect of deletion of paras 28(iv) and 28(v) complaint dated 09.07.2002 ; from Goa's

The State of Karnataka has given the details of the Complaint filed by the State of Goa and has asserted that certain paragraphs were later on deleted. Karnataka has maintained that the aforesaid deletion has an adverse

effect on the claim set up by Goa.

(a)

The State of Goa filed its Complaint dated 09.07.2002 (amended), urging the Central Government; Secretary, Ministry of Water Resources, Government of India, to

immediately constitute a Judicial Tribunal as provided under Section 3 of the Inter State Water Disputes Act, 1956, as amended, and to refer for adjudication the following:

"28.

(i)

To adjudicate and decide correctly the available utilizable water resources of the Mandovi basin at 75% dependability at various points in the basin and at Karnataka's disputed project sites.

To adjudicate and decide the equitable shares of the three co-basin states in the above quantity of water taking into consideration the long term in basin needs of the three States for the beneficial uses of water (water supply, irrigation, hydro-power generation, navigation, pisciculture and environmental protection, etc.)

(ii)

(iii) To adjudicate and decide whether in basin needs to be given priority over any contemplated extra basin diversions and whether there is any surplus left for extra basin diversions after adequately providing for long term in basin needs.

(iv) To adjudicate and decide whether Karnataka cannot meet Hubli/ Dharwad

water supply requirements from locally available water resources.

(v) To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins.

(vi) To adjudicate and decide specific restraints or restrictions to be placed on the upstream riparian states with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters.

(vii) To adjudicate and decide the machinery to implement the decision of the Tribunal."

(Emphasis Supplied by Karnataka)

(b)

The State of Karnataka states that vide its letter dated 12.01.2010 it requested the Union Government to "delete reference of Kalasa Banduri project to the proposed Tribunal' on the ground that drinking water requirement has the highest priority among the various uses of water, and therefore, such

"requirement should be seen as an issue relating to right to livelihood under Article 21 of the Constitution, rather than as regular water Disputes under the provision of the Inter-State River Water Disputes Act, 1956. ”

(c)

On 26.03.2010, the Union Government replying to the above letter dated 12.01.2010 stated that:

“As regard to deleting reference of Kalasa Banduri project to the proposed Tribunal, the Govt. of Goa vide its letter dated 10.1.2007 has deleted the reference to the issues related to providing water to Hubli and Dharwad Cities from the complaint to be referred to the Tribunal”

(d)

Karnataka maintains that till that time it was not aware nor made aware of letter dated 10.1.2007 by Goa. It appears that by letter dated 10.01.2007, the State of Goa had agreed to delete paras 28(iv) and

28(v) in its complaint dated 09.07.2002 filed under Section 3 of the Act of 1956. That letter, by Goa, has been extracted below:

"After due consideration your request vide letter dated 4/1/2007 by the Government of Goa, I am directed to inform you that the Goa's request for appointment of Tribunal under ISRWR 1956 may be processed by deleting the para 28(iv) & 28(v) without prejudice to any other contents in the Goa's request letter of 9/7/2002"

(e)

Karnataka has extracted the deleted paras viz., para 28(iv) and 28(v) of the complaint dated 09.07.2002 filed by Goa as below:

"28 (iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

(v)To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of

Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins"

(f)

Karnataka has pleaded that the complaint of Goa was, along with the complaints of other two States, referred to the Mahadayi Water Disputes Tribunal, on 11th January, 2011, on the following terms:

"In exercise of the powers conferred by sub-SECTION (1) of section 5 of the Inter-State River Water Disputes Act, 1956 (33 of1956), the Central Government hereby refers to the Mahadayi Water Disputes Tribunal for adjudication, the water dispute regarding the Inter-State river Mahadayi and the river valley thereof, emerging from letter Nos. 68-4/CE-WRD-EO-2002-03/208 dated 09th September, 2002 and letter no. CE/Mandovi Basin/2006-07/198 dated 10th January, 2007 from the Government of Goa, letter no. WRD-8-KDM-2009 dated 26th June 2010 from Government of Karnataka and letter No. Mandovi-2010/CR-247/WRP dated 13th October, 2010 from Government of Maharashtra"

(g)

According to Karnataka, It would be appreciated that since specific reference is made to the letter of Government of Goa dated 10.01.2007, there can be no adjudication with respect to whether Karnataka cannot meet the Hubli-Dharwad water supply requirements from locally available water resources, as had been contended by Goa, or that the water supply needs of Hubli-Dharwad towns being of highest priority over irrigation and hydro-power generation,

under the projects in Kali, Bedti and Ghataprabha basins. It is maintained that with the deletion of para 28(iv) and 28(v) of the complaint, and these items being dropped from the reference, the case must proceed on the basis that the water supply requirements for drinking water can only be met from Mahadayi River.

(h)

The State of Karnataka asserts that after the deletion of paras 28(iv) and 28(v) from complaint dated 09.07.2002 as discussed above, it is not open to the State of Goa to plead against the diversion of 7.56 tmc of water under the ongoing Kalasa Banduri project.

(i)

Karnataka has pleaded that Goa has waived its right to agitate against Kalasa Banduri project or the drinking water requirement of Hubli Dharwad twin cities. Goa is also barred either by estoppel or waiver from re-agitating against the Kalasa Banduri project or the

drinking water requirement of Hubli Dharwad twin cities. Karnataka submits that if Goa cannot plead on

these issues, then it is no longer open to question the Kalasa Banduri project.

D.

Effect of final judgment dated 20.01.2011 in the Original Suit No. OS 4/2006 by the Supreme Court of India:

The State of Karnataka has given the details of the proceedings pending before the Apex Court.

(a)

The order passed by the Hon'ble Supreme Court of India in the Suit, on 30.4.2008 (annexed supra) recorded the statement made by Karnataka in its affidavit dated 27.09.2006 as follows:

"As per the statement made by the State of Karnataka in its counter affidavit filed on 27th September 2006, the State of Karnataka will not actually utilize the waters or divert the waters under the Kalasa Bhanduri project till next date of hearing"

This order was continued from time to time.

(b)

Karnataka has pleaded that, however, order dated

30.4.2008 regarding the statement made in the Counter

Affidavit dated 27.9.2006 was omitted, in the order dated 20.1.2011, passed by the Supreme Court, disposing off the Suit, which is extracted below:

"In our order dated 22nd November, 2010, we referred to and recorded regarding issuance of the notification dated 16.11.2010, issued by the Central Government, constituting a Tribunal to decide the water dispute relating to the Inter-State River Mahadayi and the river valley. However, besides the said notification a separate notification was also required to be issued by the Union of India by way of referring the entire disputes to the said Tribunal. Two weeks' time was granted to the Central Government for doing the needful in the matter.

Pursuant to the said order a further notification is issued by the Union of India under notification dated 16.11.2010 for adjudication of the water dispute regarding the Inter-State River

Mahadayi and the river valley thereof. In the said order, the Central Government has referred to the Tribunal the request and complaints received from the Government of Goa, Government of Karnataka and Government of Maharashtra regarding the water disputes but, while mentioning about the letters of requests in the notification, there is some clerical mistake.

Be that as it may be, since there has been request of the aforesaid three State Governments for referring the water dispute to the Tribunal, we take the aforesaid notification on record whereby all the disputes regarding the Inter-State River Mahadayi and the river valley thereof are referred to the aforesaid Tribunal for adjudication and decision. In view of this order, all the issues that have been raised in this Suit, could be effectively raised before the aforesaid Tribunal in accordance with law.

In view of the aforesaid order, nothing survives in this Original Suit, which stands disposed of accordingly.

All the applications also pending, stand disposed of in view of this order"

Conclusions on Background Note

From the detailed narration of facts, as given above, and also the proceedings in the Supreme Court of India, Karnataka

submits as follows:

(i)

Goa had agreed to the Kalasa project of Karnataka in the interstate meeting held on 10.09.1996, and 04.10.1996, and the deputy Chief Minister of Goa had specifically appreciated the project as a "good project and it can be

beneficial to both the States” in the Inter-State meeting held on 10.01.2000.

(ii) Pursuant to the decision taken by consensus in the 3rd meeting of TC held on 02.09.1994, the NEERI was entrusted with the conduct of EIA studies, which submitted its report in September 1997.

(iii) Having agreed to the terms of reference to the NEERI in the Third TC meeting dated 02.09.1994 read with letter dated 25.01.1995, it is not open to State of Goa to state that "EIA by NEERI could be only after there is an agreement between the two states on the basis of hydrological data." (see letter dated 19.02.2001).

(iv) Findings of NEERI that there is a very marginal reduction of flow during the monsoon season (2.8%), as against a much larger flow during the non-monsoon season, which is a more critical period, hold good even on consideration of proposed consumptive utilisation of 24.15 tmc.

388

(v)

Pursuant to the Inter-State meeting under the aegis of CWC, held on 29.05.2001, the hydrological studies were conducted with the consent of party States, by the CWC in October 2001, estimating the yield in the Mahadayi basin as 180 to 220 tmc at 75% dependability; however, Goa raised objections, and was therefore asked to conduct its own studies, "at the earliest", in the Inter-State meeting dated 27.03.2002, but no such studies were submitted by Goa.

(vi) The Union Ministry of Water Resources rightly granted *"in principle clearance"* byits letter dated 30.04.2002, since; (a) Goa failed to submit its studies "at the earliest", as agreed in the meeting held on 27.03.2002, and (b) the drinking water project has the highest priority.

(vii) That, the letter dated 19.09.2002 issued by the Union Ministry of Water Resources placing "in abeyance" the "in principle clearance", granted by it vide letter dated 30.04.2002, at the instance of Goa, was entirely unjustified and erroneous, in fact and in law.

(viii) Pursuant to the decision in the Inter-State meeting held on 20.12.2002 to "reconcile the discrepancies in the data and yield figures" of the CWCs studies of October 2001, the CWC submitted its final report in March 2003. CWC by its report of March 2003 found that dependable yield figures are 6234 Mcum (220 tmc) at 50% dependability and 5652 Mcum (199.6 tmc) at 75% dependability.

(ix) According to Karnataka, having regard to the CWC yield studies of March 2003 (which is a review and improvement of October 2001 studies), Karnataka by letter dated 19.11.2004 sought revocation of the abeyance letter dated 19.09.2002. Demand was repeated continuously leading to an Inter-State meeting on 04.04.2006 deciding, inter alia, that CWC would hold meeting of administrative and technical officials.

However, Goa failed to attend the scheduled administrative and technical meeting on 26.04.2006 convened by CWC giving rise to a breakdown of negotiations.

(x)

Karnataka maintains that only after the breakdown of talks, Karnataka announced its intention to begin construction of the Kalasa-Bhandhuri project to divert 7.56 tmc, and accordingly, Karnataka's Minister for Water Resources informed the Union Minister for Water Resources by letter dated 01.08.2006 that Karnataka would "go ahead with the construction work, in the non-forest areas...".

(xi) Karnataka maintains that since the Supreme Court did not pass any restraint order against Karnataka on 28.09.2006 in IA 1 of 2006 in OS 4 of 2006 filed by Goa, there was no legal impediment to begin the construction, and accordingly, Karnataka started construction of Kalasa Bhanduri project on 02.10.2006.

According to Karnataka, a State has a right to its schemes of construction irrespective of consent of other States.

(xii) Karnataka asserts that after the deletion of paras 28(iv) and 28(v) from complaint dated 09.07.2002 by Goa, vide letter

dated 10.01.2007, it is no longer open to the State of Goa to

plead against the diversion of 7.56 tmc of water under the ongoing Kalasa Banduri project.

It maintains that with the deletion of para 28(iv) and 28(v) of the complaint and these items being dropped from the reference, the case must proceed on the basis that the water supply requirements for drinking water can only be met from Mahadayi River.

(xiii) Karnataka makes a grievance that Goa had undertaken twice to submit its studies on the yield. However, it has not submitted any studies, even as on today. Goa has failed to establish its own case on the yield despite being afforded an opportunity to do so and despite having agreed to do so.

The State of Karnataka has raised some of the above noticed objections against the Claims made by the State of Goa and has thereafter set up its own case as follows:

(i)

The Secretary, MoWR, Government of India by a letter dated 11 th January, 2011 has referred to this Hon'ble Tribunal-

"...the water dispute regarding the Inter-State River Mahadayi and the river valley thereof, emerging from letter Nos. 68-4/CE-WRD-EO-

392

2002-03/208 dated 09th July, 2002 and letter no. CE/Mandovi Basin/2006-07/198 dated 10th January, 2007 from the Government of Goa, letter no. WRD-8-KDM-2009 dated 26th June 2010 from Government of Karnataka and letter No. Mandovi-2010/CR-247/WRP dated 13th October, 2010 from Government of Maharashtra"

Therefore, the water disputes falling for consideration before this Hon'ble Tribunal emerge from all these three complaints.

Karnataka has a substantive Complaint against Goa as set out in its Complaint dated 22.06.2010.

(ii) The physiography basin are and yield issues

of

which

the

Mahadayi

the

the two

concern

complaints of three riparian States of Goa, Karnataka,

and Maharashtra.

Physiography of the Mahadayi basin:

(iii) Detailing out the Physiography, Karnataka has pleaded

that

Inter-State river

Mahadayi

and

its

valley

(Mahadayi basin) is spread across the States of Karnataka, Maharashtra and Goa.

The main river Mahadayi rises in the slopes of Western Ghats in Karnataka. The river traverses about 35 kms in Karnataka and enters Goa. It traverses about 82 kms in Goa before entering the Arabian Sea near Panjim in Goa. The main river is joined by many tributaries along its entire course.

The prominent tributaries are Surla, Kotrachi, Ragda, Khandepar, Kudne, Valvat, Bicholim, Asnode and Sinkerim. Among these tributaries, Valvat, Surla, Ragda, Khandepar originate in the territory of Karnataka and join the main river Mahadayi in Goa. Kalasa nala is a stream which rises in Karnataka and joins Surla nala in Karnataka. Kalasa nala rises in Karnataka joins Mundrichi nadi and later becomes Surla nadi which joins Mahadayi in Goa. Haltara nala stream rises in Karnataka and enters the territory of Maharashtra

and then enters the territory of Goa, where it joins Valvat River, which later joins Mahadayi in the State of Goa. Surla nala stream rises in Karnataka and joins Mundrichi nadi, later named as Surla nadi in Goa, which

joins Mahadayi in the State of Goa. Pasal nala stream rises in Karnataka and joins Ragda nadi in Goa. Karanjole nadi rises in Karnataka and joins Dudhsagar River in Goa, later called as Khandepar nadi in Goa. Lambelkond nadi rises in Karnataka and joins Dudhsagar River in Goa, later called as Khandepar nadi which joins Mahadayi in Goa. A small stream rises in Karnataka which joins Lambelkonda nadi in Karnataka. Marla nala rises in Karnataka joins Boma nadi later joins Dudhsagar and later joins Mahadayi River in Goa. Gauband nadi which rises in Karnataka and joins Dudhsagar. Bail nadi rises in Karnataka and joins Mahadayi River in Karnataka. Irti nadi rises in Karnataka and joins Mahadayi River in Karnataka. Small head streams of Kotrachi nala originates in Karnataka however, the entire river traverses in Goa and joins Mahadayi River in Goa. Bicholim, Asnode, Mapuca, Valvat, Kudne and Dicholi rivers originate and join Mahadayi in Goa.

(iv) According to Karnataka the total drainage area of Mahadayi basin is about 2032 sq. km., and out of it

about 1580 sq.km. falls in Goa, 375 sq.km. falls in Karnataka and 77 sq.km. falls in Maharashtra, as noted by CWC in its March 2003 yield studies report, which is undisputed.

(v)

The inter-State contact points between Karnataka and Goa are on the main river Mahadayi and on Kalasa nala stream, Haltar nala stream, Karanjole nadi, Lambekond, Marlanala, and Gauband nadi.

(vi) According to Karnataka, Goa in its complaint has alleged that the interception of water by Karnataka in Mahadayi affects its navigation at its harbour as alleged in para 15.1 of the complaint of the State of Goa. By such averment, Goa implies that Goa harbour is a part of Mahadayi basin. However, Karnataka submits that the harbour is located on the banks of river Zuari near its mouth. The toposheet of Mahadayi in the annexure marked above, clearly indicates that the drainage basin of Zuari River is not a part of

Mahadayi basin. Therefore, the interception of water

by Karnataka in Mahadayi basin has no bearing at all on the flows in Zuari as alleged or otherwise.

The next point taken up by the State of Karnataka is about Yield of the Mahadayi basin:

(vii) Karnataka submits that the yield of the Mahadayi basin up to Ganjim in Goa is estimated by adding upstream utilisations to the flows recorded at the gauge station maintained by the CWC. The monthly discharge or flow data of the gauge site maintained by the CWC at Ganjim from 1979-80 to 2010-11 for a period of 32 years is published by the CWC. The data compiled from the publication for the years 1979-80 to 1997-98 is a part of the study conducted by the CWC in March 2003. The remaining data from 1998-99 to 2010-11 is available on the floppy obtained from the Office of the Central Water Commission.

The discharge at Ganjim, at average, 50%

dependability, is

3398

dependability

and 75%

Mcum (120 tmc), 3314 Mcum (117 tmc), and

2893 Mcum (102 tmc), respectively. The utilisations in

the upstream region of Ganjim are very little ranging from 14 Mcum to 27 Mcum during the period 1979-80 to 1997-98 as considered by the CWC in its Study Report of March 2003. These utilizations post-1997-98 have increased and on a reasonable estimation vary from 31 Mcum to 22 Mcum in each year after 1997-98.

For each year from 1979-80 to 2010-11, the discharges at Ganjim are added to the upstream utilisations to arrive at the monthly and annual gross yield.

The annual gross yield up to Ganjim at average, 50% dependability and 75% dependability, comes to 3418 Mcum (121 tmc), 3331 Mcum (118 tmc) and 2915 Mcum (103 tmc), respectively.

(viii) Karnataka asserts that the basin beyond Ganjim and up to the mouth of the river covering the catchment of about 1152 sq. km. lying in the Territory of Goa receives very high rainfall.

However, there are no river gauge stations on

Mahadayi below Ganjim to estimate the river flows.

But, the yield below Ganjim can be estimated by statistical method which involves regression analysis of rainfall and runoff. The Indian Meteorological Department (IMD) has maintained five rainfall gauge stations in this catchment below Ganjim (see Annexure-IV, page 17 of the CWC Report of 2003). The total yield of Mahadayi up to the mouth of the river worked out in the CWC Report of 2003 is 6234 Mcum (220 tmc) at 50% dependability and 5652 Mcum (199.60 tmc) at 75% dependability. Out of the total yield of 220 tmc at 50% dependability, and 199.6 tmc at 75% dependability, the gross yield up to Ganjim in Goa, as stated earlier, is 118 tmc at 50% dependability and 103 tmc at 75% dependability.

(ix) Placing reliance upon CWC 2003 Report, Karnataka maintains Yield below Ganjim was estimated in the CWC report of 2003, in the following manner:

(a)

Firstly, the CWC analysed the rainfall of the catchment up to Ganjim.

399

(b)

Secondly, the CWC considered the gauged flows at Ganjim as measured by the CWC gauge station.

(c)

Thirdly, a co-relationship was established between the estimated weighted average rainfall and measured run-¬off up to Ganjim.

(d)

Fourthly, the co-relationship obtained between weighted average rainfall and measured runoff at Ganjim was used to estimate the runoff for the entire Mahadayi basin by establishing the equation, which is stated as RO = A x P + B, where A is a multiple of rainfall, P is monsoon

weighted rainfall in mm and B is a constant value obtained by correlating observed rainfall and measured runoff up to Ganjim.

(e)

Fifthly, the value arrived for 'A' by CWC is 0.87891, the value arrived for 'B' by the CWC is: 49.6451 and the value considered for 'P' by the CWC varied from year to year.

(f)

Sixthly, the CWC estimated the yield of Mahadayi basin as 6234 Mcum (220 tmc) at 50%

dependability and 5652 Mcum (199.6 tmc) at 75% dependability.

(x) Karnataka points out that the State of Goa has raised objections against the said estimation of yield made by CWC in 2003. According to Goa, as recorded in the minutes of the Inter-State meeting held on 27.03.2002, the "rainfall data for the year 1901 to 1931 have to be included because the above period consists of large consecutive number of distress years".

But, the CWC has explained in this regard in para 3.1.1 of its Report as –

"There are 15 raingauge stations in and around the catchment area for which the data has been supplied by IMD, Pune. IMD vide letter dated 9th March, 2003 have informed that no further data are available with them. These data are available for varying periods from 1901 to 2001. The data in respect of only four stations viz., Supa, Panjim, Khanapur and Marmagoa is available from 1901 onwards. But the stations Supa, Khanapur and Marmagoa lie completely outside the basin. The rainfall

station Panjim lies in the basin but is located near the confluence of the river with sea. As such, the rainfall data for the period from 1901 to 1927 is not considered for the study.

The data of five raingauge stations viz., Valpoi, Colem, Mapuca, Ponda, Margao (Madgaon), is available from 1928 onwards. In addition to these data, the rainfall data of the stations, Khanapur and Panjim for the period 1928 to 2000 have been used."

(xi) The yield of the Mahadayi River basin lying in the territory of Karnataka up to the border has been worked out by the Water Resources Development Organisation (WRDO) of Karnataka Government. The WRDO of Karnataka has adopted the same methodology as adopted by the CWC in its Report of 2003. According to WRDO of Karnataka, for the period 1965-66 to 1999-2000, the yield, at 75% dependability

and 50% dependability, are 44.15 tmc and 52.60 tmc, respectively. The WRDO of Karnataka has also assessed the yield on the proportionate catchment area basis of the gross yield at Ganjim, for the period from 1979-80 to 2010-11. According to the study of

WRDO of Karnataka, the yield at 75% dependability and 50% dependability is 43.87 tmc and 50.13 tmc, respectively.

(xii) Karnataka pleads that as a part of water balance studies of Mahadayi basin, the NWDA had earlier in 1989 estimated the yield of the Mahadayi basin as 5703 Mcum (201.40 tmc) at 50% dependability, and 3164 Mcum (111.80 tmc) at 75% dependability. The study was based on annual yield of six years viz., 1980-81, 1981-82, 1982-83, 1983-84, 1984-85 and 1985-86. However, due to the objections of Goa, CWC had to conduct fresh study in October 2001, which was revisited by CWC in March 2003. Goa had undertaken twice to submit its studies on the yield. However, it has not submitted any studies, even so far.

Karnataka maintains that Goa has failed to establish its own case on the yield, despite being afforded an opportunity to do so, and despite having agreed to do so. Therefore, Karnataka submits that

this Tribunal may draw an adverse inference against

403

Goa in respect of yield studies and the CWC study of March 2003 has to be taken as the basis.

Karnataka, thereafter, has dealt with Goa's complaint dated 09.07.2002:

(i)

Karnataka has given about the details of the prayers, made in para 28 of the Complaint dated 09.07.2002, filed by Goa, under Section 3 of the Act of 1956, as under:

“28.

(i)

To adjudicate and decide correctly the available utilizable water resources of the Mandovi basin at 75% dependability at various points in the basin and at Karnataka's disputed project sites.

To adjudicate and decide the equitable shares of the three co-basin states in the above quantity of water taking into

consideration the long term in basin needs of the three States for the beneficial uses of water (water supply, irrigation, hydro-power generation, navigation, pisciculture and environmental protection, etc.

(ii)

(iii) To adjudicate and decide whether in basin needs to be given priority over any

contemplated extra basin diversions and whether there is any surplus let for extra basin diversions after adequately providing for long term in basin needs.

(iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

(v)

To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kaii, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins.

(vi) To adjudicate and decide specific restraints or restrictions to be placed on the upstream riparian states with regard to construction

and regulation of their projects, during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters.

(vii) To adjudicate and decide the machinery to implement the decision of the Tribunal."

(xiv) However, Karnataka claims that Goa by its letter dated 10.01.2007, had requested the Secretary, MOWR that

405

its complaint dated 9.7.2002 "may be processed by deleting para 28(iv) and 28(v)...". Accordingly, in the reference letter dated 11.1.2011, the Secretary MOWR had sought to exclude paras 28(iv) and 28(v) and water disputes emerging there from, by mentioning the letter dated 10.1.2007 along with the complaint of Goa dated 9.7.2002. Therefore, according to Karnataka, the case of Goa has been answered by Karnataka without considering paras 28(iv) and 28(v) of the complaint dated 9.7.2002.

(xv) Karnataka has asserted that after excluding paras 28(iv) and 28(v), the entire reference to Kalasa Bhanduri project in other parts of the complaint becomes irrelevant for any consideration. Para 28(i)

relates to the estimation of the dependable yield of the Mahadayi/Mandovi basin at 75% dependability at various points, para 28(ii) concerns decision on the equitable shares of the three co-basin States, para 28(iii) speaks of giving priority to the in-basin needs, para 28(vi) calls for imposition of restrictions on the upstream riparian States with regard to construction

and regulation of the projects and para 28(vii) seeks direction for constitution of a machinery to implement the decision of the Tribunal.

(xvi) According to Karnataka, Goa has sought water determination of "…. available utilisable resources of the Mandovi basin at 75% dependability at various points in the basin and at Karnataka's disputed project sites" in para 28(i) of its Complaint, which Karnataka has already opposed in earlier parts of its pleadings.

(xvii) It is pointed out that Goa has sought a decision on the

equitable share by taking into consideration "the long term in-basin needs of the three States for the beneficial uses of water" in para 28 (ii) of its Complaint. Goa has also pleaded for priority to the in-basin needs in para 28(iii). Karnataka submits that equitable share of a State in a virgin basin like Mahadayi is determined having regard to the basin factors viz., drainage area, contribution and the present needs. The drinking water requirements have

highest priority. The needs of the basin undoubtedly have priority, though trans-basin diversion is not legally barred. Karnataka submits that equitable apportionment allocating shares to the riparian States arises if there is a conflict or incompatibility in the claims. However, the claims made by the riparian States even if considered in their entirety, there is no conflict requiring apportionment of the water. The State of Karnataka, in its Complaint has claimed its equitable share in Mahadayi as "not less than 45 tmc (consumptive utilization restricted to 24.15 tmc”). The State of Goa in its complaint at para 12.8 (iii) has stated that its "projected annual requirement" is 2674 Mcum (94.40 tmc) by 2051 AD. In the complaint, the State of Goa has

also

highlighted

the

environmental needs for maintaining the flora and fauna. These needs are met by maintaining summer flows during months of off-season i.e., January to May. State of Karnataka has stated that though the State of Goa has not mentioned the quantity of water, either in terms of volume or discharges, but the

standard practice has been to maintain the discharge of about 200 to 500 cusecs. State of Karnataka has further stated that quantitatively, the discharge of 200 cusecs and 500 cusecs during January to May, covering 150 days works out to 2.6 tmc and 6.5 tmc, respectively. Therefore, the entire projected water requirement of Goa, that includes the total planned uses of 94.40 tmc, (which is totally unrealistic and unjustified, according to Karnataka), and environmental needs of 6.50 tmc, come to about 100.90 tmc annually (though not admitted by Karnataka).

According to State of Karnataka the utilisation claimed by Maharashtra in its complaint dated

13.10.2010 is with reference to its sole project viz., Virdi irrigation project for the utilisation of about 15.373 Mcum (543 Mcft) which is equal to 0.50 tmc. The total projected annual water requirement of Goa of 100.90 tmc, the proposed consumptive utilization of 24.15 tmc by the State of Karnataka and proposed diversion of 0.50 tmc by Maharashtra add up to only 125.55 tmc (without prejudice).

However, the available water as estimated by the CWC in the Mahadayi basin is 199.60 tmc at 75% dependability or 220.00 tmc at 50% dependability. From these figures, it is clear that a large quantity of surplus water is available in the Mahadayi basin. Hence, there is no conflict or lis between the claims of the riparian States.

(xviii)On the question of restrictions and regulations in para 28(vi) and machinery in para 28(vii) of the Complaint of Goa, Karnataka submits that it is open to any reasonable suggestion in this regard, Goa has not made any specific case of restriction in its complaint. The nature of restrictions and type of machinery depend on the apportionment to be made by this Tribunal.

Further a reference has been made by the State of Karnataka to its Complaint dated 22.06.2010.

The specific matters in dispute raised by the State of Karnataka in its Complaint are:

410

(a)

Whether, the available water for allocation in the interstate river Mahadayi and its valley is not less than 220 tmc at 50% dependability?

What is the available water at Haltar Dam, Kalasa Dam, Kotni Hydro-power Dam, Bail Nadi Dam Site, Bhandura Dam site and entire catchment in Karnataka and Ganjim G&D site on main river, Khandepar at Colem G&D site and entire catchment up to mouth of the Sea of Goa in the interstate river Mahadayi and its valley?

What is the contribution of water of each of the riparian States of Karnataka, Goa and Maharashtra to the available water of interstate river Mahadayi and its valley?

On an equitable apportionment of the waters of the interstate river Mahadayi and

its valley, whether, the equitable share of the riparian State of Karnataka is not less than 45 tmc annually (consumptive use of 24.15 tmc)?

Whether the State of Karnataka is entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of waters every year of

(b)

(c)

(d)

(e)

the interstate river Mahadayi to the Malaprabha river in the Krishna basin?

(f)

Whether, the inhabitants of twin city of Hubli-Dharwad, town and villages have a right to drinking water from the waters of inter State river Mahadayi diverted under the Kalasa-Bhanduri Project? If so, does not such right have a higher priority over other uses of the waters of the said river?

Whether, the State of Karnataka would be justified in diverting waters of the interstate river Mahadayi and its valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project? If so, what extent of diversion is just and reasonable?

Whether, the State of Karnataka is entitled to execute Kotni hydro power project on

the interstate river Mahadayi for generation of electricity on the main river Mahadayi? If so, to what extent?

As alleged, whether, the State of Goa and its inhabitants would be prejudicially affected by the executive actions of the Government of the State of Karnataka in the waters of Inter-State river Mahadayi and its valley?”

(g)

(h)

(i)

412

(xix) Karnataka pleads that in its complaint dated
22.06.2010
it
has
also
sought
equitable
apportionment of the waters of Mahadayi by
allocating 24.15 tmc of consumptive
its share. The complaint states that:
utilization
to

"1.1 ....the interest of the State of
Karnataka and its inhabitants in the waters
of the Inter-State river Mahadayi and its
valley have been or are likely to be
prejudicially affected by:

(a)
the executive actions of the

Government of Goa resulting in denial of equitable share to the State of Karnataka in the available waters of the interstate river Mahadayi and its valley, which is not less than 45 tmc (consumptive use of 24.15 tmc).

(b) the executive actions of the State of Goa in protesting against and attempting to prevent works undertaken for diversion of 7.56 tmc of water in the interstate river Mahadayi by the Government of Karnataka under the Kalasa- Bhanduri project (a Drinking Water Project for inhabitants of Hubli-Dharwad and towns and villages en route)".

(xx) Karnataka states that out of the planned utilization of 24.15 tmc, 7.56 tmc is proposed for diversion under Kalasa Bhanduri as mentioned in the complaint. The remaining 16.59 tmc is proposed to be utilised under the Kalinadi Hydro Electric Project (KHEP) and Mahadayi Hydro Electric Project (MHEP) at Kotni, as mentioned in para 3(i)(g) and 3(i)(h) of the complaint though extent of utilisation in each of the two projects was not mentioned.

On a fresh planning, Karnataka proposes to (i) utilize 7.56 tmc for diversion under Kalasa Bhanduri (ii) utilize 1.5 tmc for irrigation, drinking purposes and other purposes within the Mahadayi basin (iii) divert 5.527 tmc to Kalinadi to augment the flows for power generation under the KHEP and (iv) account remaining

water under the MHEP for power generation, at present.

(xxi)

The State of Karnataka has relied upon a Project Report for *'In-basin utilisation of Mahadayi Waters in Karnataka.'* Inthe said report it has been indicated

414

that

a

number of

industries including

Tailoring,

bricks

manufacturing,

Carpentry,

embroidery

works, paper crafted articles, cane furniture etc., are already existing and some more bricks manufacturing factories are being proposed in and around the basin. It is projected that, industrial requirement of water in the basin will be 0.077 tmc. Since the area

consists

of ecologically sensitive, bio-diverse flora and fauna, certain water requirement will be essential for irrigated forestry, wildlife conservation and tourism etc., the water required is 0.378 tmc. Total

requirement for industrial and other requirements will be about 0.45 tmc.

There are 18 villages in Mahadayi Basin, in Karnataka, with a total population of 9963. The drinking water requirement of the projected population by 2050 including live stock is 1.35 Mcum (0.05 tmc). Total cultivable area in the basin in Karnataka State is 1369Ha with sugar cane as the main crop. Water requirement for the cultivable area for Sugarcane which is the main crop grown works out to 1.352 tmc for 1228 Ha.

415

(xxii) According to Karnataka, there is no conflict or lis between the claims made by Karnataka and the entire claims made by Goa (Karnataka states that, even assuming for the sake of argument that such claims are justified both on law and facts). It is maintained that there is enough water for planned utilization of all 3 States - though Karnataka specifically puts Goa to strict proof of its claims.

According to Karnataka, Goa is not affected prejudicially by Karnataka's proposed consumptive utilisation of 24.15 tmc, either to the existing or to the prospective utilisations, permissible within its equitable share to be determined by this Tribunal.

Karnataka has also referred to Maharashtra complaint dated 13.10.2010

(xxiii) Karnataka had claimed, as a part of its share on equitable apportionment, a consumptive utilisation of 24.15 tmc from the waters of Mahadayi basin, as stated in its Complaint dated 22.06.2010 filed under Sec. 3 of the Act of 1956.

(xxiv) Out of the said 24.15 tmc of water, Karnataka plans to utilize 7.56 tmc of water under Kalasa Nala Diversion Scheme, and Bandura Nala Diversion Scheme, which are together described as Kalasa Bandura project.

(xxv) According to Karnataka, the utilisation of remaining water of 16.59 tmc (24.15 - 7.56 tmc), was not mentioned in the said Complaint dated 22.06.2010, though the names of the projects namely Kali diversion and Kotni Hydro power diversion were indicated in the Complaint.

Kalasa Bandura Project (Drinking Water Project)

(xxvi)

Giving details of Kalasa Bhanduri Project, Karnataka pleads that the Kalasa Banduri project for diversion of 7.56 tmc consists of diversion of 3.56 tmc under Kalasa Nala diversion and diversion of 4 tmc under Bhandura Nala to augment the flows of Malaprabha river and consequently to meet the drinking

water

requirement

of

Hubli-

Dharwad twin cities (including villages en route and Kundgol town) situated in the catchment in the Malaprabha sub basin in the Krishna basin.

(xxvii) The pleadings state that Malaprabha Dam and reservoir are used to facilitate the transmission of water proposed to be diverted from the River Mahadayi to supply drinking water to twin cities of Hubli-Dharwad and villages en-route etc. It is reiterated that the existing facilities of infrastructure at Malaprabha are put to further use as it is highly convenient, economical & viable for purpose of diversion of Mahadayi waters for drinking water as aforesaid.

(xxviii) According to Karnataka, the first Detailed Project Report (Kalasa DPR-2000) of the Kalasa

Nala

Diversion Scheme was prepared in the year 2000, by the Chief Engineer, Irrigation (North), Belgaum, for diversion of 3.56 tmc of water to Malaprabha river. The sanction scheme was by Government granted administrative of Karnataka on

418

22.08.2000,

for

the estimated

cost

of

44.78

crores. The works proposed under the Scheme

are as below:

"COMPONENT-1: Construction of Kalasa

dam and open channel with cut and cover

connecting Kalsa reservoir to Malaprabha

River to divert water from Kalasa reservoir.

COMPONENT-2: Construction of

Haltar Dam and Open channel to divert 0.56

tmc of water of Haltar nala and 0.85 tmc of

Surla catchment to Kalasa reservoir.

DETAILS OF COMPONENT-1:

This component consists of two works i.e.,

construction of Kalasa Dam and

construction of Diversion channel from
Kalasa reservoir to Malaprabha river".
(xxix) Karnataka describes the salient
features
of
the
scheme stating that the catchment area of the
Kalasa dam and Haltar dam are 21.50 sq.km.
and
4.00 sq.km,
respectively.
The
yield
was
estimated as 2.15 tmc and 0.56 tmc, respectively.
The submergence under the FRL of Kalasa dam
and
Haltar
dam is 186.87
Ha
and

40.41 Ha

respectively. A revised Detailed Project Report of Kalasa Nala Diversion Scheme was prepared in 2010 by the office of the Chief Engineer, KNNL, Malaprabha Project Zone, Dharwad (Kalasa DPR-2010). The work component of Kalasa DPR-2010 is the same as work component of Kalasa DPR-2000, except that the open cut and cover channel is now converted into RCC conduit. The revised estimate of the project is shown as Rs. 404.21 crores. The need of the project is specifically described as - "...to augment the storage in the Malaprabha reservoir by diversion of water from Kalasa Nala "

(xxx) Karnataka further states that the Bhandura Nala Diversion Scheme, which

envisages

diversion of 4

tmc of water to the Malaprabha river, was given

administrative

estimated cost

Government of

sanction

of

on 22.08.2000,

crores,

based on

at the

by

the

Rs.49.2

Karnataka

the DPR

prepared in the year of 2000 (Bhandura DPR-2000). The work components are construction of a dam across the Bandura Nala and diversion of the

storages by an open cut canal to the Haltara Nala - a tributary of Malaprabha River.

The Salient features of the Scheme show that the catchment area of the Bandura dam is 32.25 sq.km. The yield of the catchment estimated is 4.0 tmc. The submergence estimated was 330 hectares (the scope of the project is modified to divert water at Bhandura point from water spread of Kotni HEP dam.

A revised Detailed Project Report of Bhandura Nala Diversion Scheme was prepared in 2012 (Bhandura DPR-2012). The work component and Salient features described in the Bhandura DPR-2012 is same as described in the Bhandura DPR-2000.

Regarding the need of the project, it has been specifically stated that - "In view of the reduction in the flow of Malaprabha River at the dam site, the meeting of drinking water needs of Hubli & Dharwad city and surrounding villages has become a difficult task. The drinking water supply to twin cities has been

met once in 10 days. Hence Karnataka had planned to divert a small quantity of 7.56 tmc of its Mahadayi basin contribution to Malaprabha reservoir, so as to

meet the drinking water requirements of Hubli &
Dharwad
cities,
other
towns
and
villages
of
Malaprabha Basin, by planning Kalasa Nala and
Bhanduri Nala Diversion Schemes".

(xxxi) Karnataka maintains that the Kalasa Nala Diversion Scheme for 3.56 tmc for drinking water had been approved by the State of Goa, as recorded in the minutes of
interstate meeting of 10.09.1996 and
04.10.1996, and reiterated by the Deputy Chief Minister of Goa on 10.01.2000, (all documents on record).

The Bandura Nala Diversion Scheme for 4

tmc (totaling 7.56 tmc), under the name Kalasa Bhandura project, are intended to augment the flows of the Malaprabha river, and thereafter, the flows under the existing infrastructure are lifted, first at Malaprabha reservoir to a height of 120 meters, and then from the treatment plant at Aminbhavi to a height of 50 meters for supplying water to Hubli, and to a height of 160 meters for supplying water to Dharwad, to meet their drinking water requirement.

422

(xxxii) Karnataka asserts that the need for augmentation

of

the

Malaprabha

water

reservoir

of

to meet

the

drinking

requirement

Hubli-Dharwad

has arisen because the Malaprabha reservoir has

been facing severe shortage of water since, the

reservoir

inflows

as

has

was

not

been able to

realize

the

expected while planning in 1960.

The Detailed Project Report of Malaprabha prepared in 1970 (Malaprabha DPR 1970) estimated the dependable yield as 47.25 tmc.

(xxxiii)

Karnataka pleads that, the inflow data of 1972-73 to 2005-06 show that the dependable yield is only about 27 tmc - the shortage being 17 tmc. A revised Detailed Project Report of Malaprabha prepared in 2009 (Malaprabha DPR-2009) has discussed the decline in the yield as extracted below:

"The dependable yield of Malaprabha river at the dam site worked out by the three methods are recapitulated as follows: -

423

1. By Isohyetal method as

approved project

report

1331 million per

cubic meters

2. By analysis of rainfall

Records

1338.12 million

cubic meters

3. By correlation of the long

term and short-term yields

on the basis of records of

hydrologically similar

Catchments.

1373.52 million

cubic meter

Thus, the dependable yield of 1338.12

million cubic meter (47.255 TMC) of the

Malaprabha River at the dam site is considered

in the modified planning of the Malaprabha project, which was cleared by the planning commission in 1963. Thus, earlier committed utilisation of 37.2 TMC (including 6.08 TMC evaporation losses) for Malaprabha project was enhanced to 44.00 TMC, while project wise allocation of water for irrigation projects made in September 1993.

It is observed that the dam has filled to FRL only for six years since completion. Upper reaches of Malaprabha catchment (Khanapur taluk of Belgaum district receives rainfall of 4000 mm, but catchment coming under chronically draught hit

taluks of Bailhongal, Soundatti receive rainfall less than 500 mm). After studying inflow details at Malaprabha dam, for the period from 1972-73 to 2005-06, the 75% dependable yield is 26.76 TMC after the construction of the dam".

(xxxiv) Karnataka pleads that the Malaprabha DPR 2009 was posed to the CWC for clearance. In the 100th meeting of the Advisory Committee of CWC held on 09.10.2009, the Malaprabha DPR 2009 was considered as item 14 of the agenda and resolved that - "After brief discussion the Committee accepted the proposal". Karnataka therefore submits that the dependable yield of the catchment of the Malaprabha project has gone down from 44 tmc to 27 tmc the

shortage being about 17 tmc should stand established by the submissions.

(xxxv)

According to Karnataka, the urgent need of meeting the drinking water requirement of Hubli-Dharwad twin cities, en-route villages, etc., has been the singular reason for starting the construction of Kalasa Bhanduri project for diversion of 7.56 tmc of water to

425
Malaprabha
River,
to
augment
city
its
being
is
inflows.
second
head
and
Hubli-Dharwad is the
largest in
the
State.
twin
Dharwad
the

one

quarter of the district for the

last

half century. It is known as the educational

hub

with

three

important

universities, namely,

Karnataka University which started in 1949; University of Agricultural Sciences in 1985; and Karnataka State Law University in 2009.

Besides, Dharwad has an Engineering College, Medical College, Dental College and Nettur Technical Training Foundation.

The Circuit Bench of the High Court of

Karnataka

has

also been set up in 2009, which

exercises jurisdiction over the matters coming from

the districts of Belgaum, North Kanara, Dharwad,

Gadag, Haveri, Bagalkot, Koppal and Bellary. Dharwad has also acquired its place in the Industrial sector. The prominent factory is the manufacturing unit of TATA Motors. Hubli is a part of Dharwad district and known to be the commercial center in north Karnataka. Series of educational institutions are also found in Hubli.

Hubli is the headquarter of south-west railway division. Hubli is also serviced by air with an airport. The twin city of Hubli-Dharwad covers an area of 202.28 sq.km. The population as per the census of 1951, 1961, 1971, 1981, 1991 and 2001 was 1,88,180, 2,48,489, 3,79,166, 5,27,108, 6,48,298 and 7,86,195, respectively. As on the year 2011, the census population was 9,43,857. The projected population for the years 2021, 2031, 2041, 2051 and 2061 is 12,39,553, 16,27,886, 21,37,878, 28,07,643 and 36,87,235 respectively. The rate of growth of population of urban areas in the next 30 to 40 years is most likely to grow at a very high rate, due to the rapid urbanization process.

The Karnataka Urban Water Supply and Drainage Board (KUWS & DB), in its "Report on Drinking Water Demand of Hubli-Dharwad, en-route villages, etc., from Malaprabha Reservoir" estimated the projected

population in para 5.3 under the heading Population Forecast which is extracted below:

"5.3 Population Forecast

427

As per CPHEEO manual, the design population will have to be estimated with due regard to all the factors governing the future growth and development of the project area in the industrial, commercial, educational, social and administrative spheres as per CPHEEO manual. Special factors causing sudden emigration or influx of population should also be foreseen to the extent possible. A judgment based on these factors would help in selecting the most suitable method of deriving the probable trend of the population growth in the area or areas of the project from out of different mathematical methods.

Hubli-Dharwad is a fast-growing city and it has vast scope for expansion. It is a major commercial and educational hub in entire North Karnataka. There is huge

potential for industrial growth around

Hubli-Dharwad on account of following

reasons:

The commencement of Karnataka

High Court Bench and the Suvarna Soudha

near Belgaum has led to sudden growth of

population and industrial activity.

Further;

(a)

It is located midway between Pune and Bangalore,

428

(b)

(c)

(d)

(e)

(f)

It is well connected by Highways and Railways,

Presence of Airport in Hubli,

Availability of vast stretches of land,

Abundance of technical, skilled and

unskilled manpower,

Necessary to improve the backward areas

around Hubli-Dharwad.

Hence, for population forecast of Hubli-

Dharwad, Geometrical Increase Method has

been adapted. The projected population of

Hubli-Dharwad in the year 2051 works out to

28.08 Lakhs (Table 3.1.1). For Hubli- Dharwad, a

floating population of 1 lakh is considered for

the year 2011 and projected to 2.97 lakhs in

2051 (Table 3.1.1). The projected population of Kundgol town in the year 2051 will be 0.36 Lakhs. For en-route villages, the forecast population in the year 2051 will be 1.94 Lakhs. The live-stock populations of Hubli, Dharwad and Kundgol taluks in 2007, are 1.92 lakhs of cattle/buffaloes, 0.77 lakh of Sheep/Goat and 3.17 lakhs of Poultry Chicken. The projected live-stock populations of Hubli, Dharwad and Kundgol taluks in 2051 are 3.56 lakhs of cattle/buffaloes, 1.35 lakh of Sheep/Goat and 5.88 lakhs of Poultry Chicken."

(xxxvi) On the question of the domestic water requirement, Karnataka submits that at present Hubli-Dharwad twin cities, en-route villages, etc., require about 3.06 tmc

(In 2011) of water. The projected requirement of Hubli-Dharwad twin cities, en-route villages, etc., is 7.56 tmc for the year 2044, and 8.69 tmc for the year 2051. The KUWS & DB in its above report, at para 5.4 under the heading "Per-capita rate of supply", at para 5.5 under the heading "Calculation of Domestic water demand of Hubli-Dharwad, en-route villages, etc.," and at para 6 under the heading "Conclusion" has estimated the said requirement of 7.56 tmc for the year 2044, which is extracted below:

“Per Capita Rate of Supply

For selecting per capita rate of supply, the Manuals and Guidelines listed in Para 5 have been referred.

Central Public Health Engineering and Environmental Organization, (CPHEEO) Manual recommendations are as follows:

Piped water supplies for communities should provide adequately for the following

as applicable; Domestic needs such as drinking, cooking, bathing, washing, flushing of toilets, gardening and individual air conditioning, Institutional needs, Public purposes such as street washing or street watering, flushing of sewers, watering of public parks, Industrial and commercial uses

including central air conditioning, Firefighting, Requirement for livestock, and Minimum permissible UFW at 15%. The factors affecting consumption are as follows; a) Size of city, b) Characteristics of Population and Standard of Living, C) Industries and Commerce, d) Climate Conditions, e) Metering. In the high value residential area of the city or in a suburban community, per capita consumption is high. Slum areas of large cities have low per capita consumption. Habit of person also affects consumption; the type of bath i.e. tub bath or otherwise and material used for ablution etc., also affect per capita consumption. The type and number of different industries also affect consumption. Commercial consumption is that of the retail and wholesale mercantile houses and

office buildings. In hot weather, the consumption of water is more compared to that during cold weather. The bulk requirements of water for institutional, commercial and industries are to be assessed separately. As per CPHEEO Manual Clause 2.2.8.1 Table 2.1, a per capita supply rate of 135 LPCD has been considered for Hubli-Dharwad and Kundgol town. In the drinking water requirement assessment, for en-route villages a per capita supply rate of 70 LPCD is adopted. As per Reference(c) in Para 5.1, for live-stock, per animal supply of 35 LPCD for cattle/buffaloes and 25 LPCD

for Sheep/Goat/Poultry

adopted.

Chicken

are

5.4 Calculation of Domestic Water

Demand of Hubli-Dharwad twin city, en-

route villages, etc.,

The Calculation of Domestic Water

Demand of Hubli- Dharwad twin city, en-

route villages, etc., is done for the years

2011 to 2061. The distribution losses are

taken at 15% as per CPHEEO manual. The

reservoir evaporation losses are calculated

at 9.44%, as the evaporation losses in

Malaprabha dam was furnished as 2.55

TMC out of 27 TMC utilization.

As per CPHEEO manual clause 2.2.8.3

(c), along with domestic water demand, it is

usual to provide for fire demand as a

coincident draft on the distribution system along with the normal supply to the consumers as assumed. A provision in kiloliters per day based on the formula of 1OOVp where p= population in thousands may be adopted Hubli-Dharwad are fast growing cities and it has vast scope for expansion. It is a headquarters of many major offices and also a prominent educational center in entire North Karnataka. As per CPHEEO manual clause 2.2.8.3 (c), the water requirements for institutions are included.

The domestic water demand for Hubli-Dharwad twin city, en-route villages, etc., works out to 7.56 TMC and 8.69 TMC for the years 2044 and 2051, respectively.

6. Conclusion

As per National Drinking Water Policy 2002, Clause 5, in the planning and operation of systems, water allocation priorities should be broadly as follows:

1.

2.

3.

4.

5.

Drinking water

Irrigation

Hydro-power

Ecology

Agro-industries and non-

agricultural industries

6. Navigationand other uses.

The present total water requirement of Hubli-Dharwad, en-route villages, etc., from Renuka Sagar dam is about 3 TMC. The allocation of water from Renuka Sagar dam drinking purpose as per '!'Approved Revised DPR of Malaprabha Project" is only 0.216 TMC (Annexure 4) because of the shortage in yield. The deficiency in requirement is about 2.8 TMC of water.

Hence, it is necessary to allocate the above water requirement of 7.56 TMC to meet domestic demand of Hubli-Dharwad twin city, en-route villages, etc., depending on Malaprabha reservoir near Soundatti town, through diversion of Mahadayi river water to Malaprabha basin."

(xxxvii) Karnataka maintains that against the present demand for 215 MLD (including distribution losses) of water for Hubli-Dharwad, Kundgol town, en-route villages and livestock, the present bulk supply is 173.8 MLD from the following sources of supply, including partial drawl from Neerasagar source scheme, which is not reliable:

(i)
Kelgeri tank near Dharwad constructed in 1912 - abandoned long ago.

(ii)
Unkal tank constructed in 1912
abandoned in 1996.

near Hubli –

(iii) Neerasagar dam (phase I) (18 MLD) constructed

in 19 Neerasagar dam (phase II) (22 MLD)

constructed in 1969.

Neerasagar source is not reliable, as it was

dried up during 1986-87 and 2001-03. During the

monsoon of year 2012, also there was no inflow into the reservoir. Hence supply from Neerasagar source needs to be ignored.

(iv) Malaprabha water supply scheme (stage I) (34 MLD) constructed in 1983 Malaprabha water supply scheme (stage II) (34 MLD) constructed in 1993 with a total capacity of 68 MLD.

The above scheme was upgraded in the year 2004 by replacing the jack well, water treatment plant, transmission main and pump sets. The bulk supply was augmented from 68 MLD to 73.8 MLD.

(v) Malaprabha water supply scheme (stage III,

phase I) (80 MLD) constructed in 2011.

(xxxviii) Karnataka maintains that the present total water requirement of Hubli-Dharwad, Kundgol town and en-route villages from Malaprabha (Renuka Sagar) dam is about 2.8 tmc. The allocation of water from Malaprabha dam for drinking purpose, as per "Approved Revised DPR of Malaprabha Project", is

only 0.216 tmc. Further augmenting supplies from the Malaprabha Scheme are impossible, as the farmers of Malaprabha command are threatening to blow up the pipes.

(xxxix)

Karnataka, while detailing about the Mahadayi Hydro-Electric Project (MHEP) for the generation of hydro-electricity, states that the same was first conceived in 1960s. The detailed project report was prepared in 1987 (MHEP DPR of 1987). According to this, a dam was proposed across river Mahadayi at Kotni for storage of 14.85 tmc of water. In the downstream reach of Kotni dam, a pick-up dam was proposed at Irti, the water from Bailnadi and Irti streams was proposed to augment the Kotni reservoir under the scheme. The water from the pickup dam at Irti was proposed to be channeled through a tunnel to a power house at Krishnapur located about 9 km in the

downstream

reach.

The

head

available

between Irti reservoir and

was

463m.

By this

the power house

process, hydro-power

proposed to be

generation of 905 MU was

generated by installing a generating capacity of 305 MW.

However, when the Government of Karnataka proposed a diversion of 4.00 tmc of water to Malaprabha river to augment the flows of Malaprabha reservoir, a revised detailed project report was prepared in 1990 (MHEP DPR of 1990).

Under this new scheme, the installed generating capacity was increased to 345 MW for generating 828 MU of energy. The components of the work remained the same. The scheme underwent further change when Karnataka proposed the Kalasa Bhanduri Project for the diversion of 7.56 tmc of water to Malaprabha River.

A revised detailed project report was prepared in 2002 (MHEP DPR of 2002) by reducing the height of Kotni dam from FRL 660m to 640m.

(xl)

Karnataka states that as a result of reduction of the

height of the dam, the
generating capacity
was
reduced from 345 MW to 320 MW and the
power generation was reduced from 828 MU to 635
MU. However, even this has been proposed to be

changed in view of the declaration of Bhimgad Wildlife Sanctuary by a Notification dated 28.11.2011. As the headrace tunnel and power house are falling inside the Bhimgad Wildlife Sanctuary, Karnataka has decided to shift the tunnel and the power house away from the notified area of the sanctuary.

(xli)

The yield in Mahadayi River up to Kotni, under MHEP project is 14.564 tmc, and up to Irti dam (below Kotni dam) is 1.134 tmc, coming from independent catchment. There will be an augmentation by diversion of 1.019 tmc from Irti stream and 3.754 tmc from Bailnadi to MHEP. The MHEP requires a consumptive use of 0.40 tmc as evaporation losses. Hence, the available yield to MHEP would be 20.071 tmc (14.564 + 1.134+ 1.019 +3.754-0.40 tmc).

(xlii)

Kalinadi Hydro Electric Project; Katla & Palna Diversion Scheme (KHEP and KP diversion): Karnataka has

pleaded that diversion from Mahadayi basin water to augment Kali basin, for enhancing the hydro power generation from the Kali Hydro Electric Project (KHEP),

was first proposed in mid-1980s, A detailed project reports was prepared in 1985 viz., Katla & Palna Diversion Scheme (KPDS DPR of 1985), Viranjole Diversion Schemes (VDS DPR of 1985) and Diggi Diversion Scheme (DDS DPR of 1985). Under these schemes of Kali diversion, 5.527 tmc of water was proposed to be diverted to Supa reservoir of KHEP. Karnataka has now planned revision of the Kali diversion by adding one more scheme viz., Castle Rock Diversion Scheme.

(xliii)

The Central Water Commission (CWC) in October 2001, (revisited in March 2003), estimated the available water in the basin at 50% dependability and 75% dependability as 220 tmc and 199.60 tmc, respectively.

The Report of the Central Water Commission of October 2001 and March 2003 have been appended by the State of Karnataka to its

Statement of Claims, filed on 02.01.2013, and has strongly relied upon the same.

439

(xliv)

It is pleaded that the Water Resources Development Organisation, Government of Karnataka, has separately estimated the available water in the Karnataka part of Mahadayi basin in a Technical Note which is attached to the Statement of Claims filed on 02.01.2013. In the said Technical Note, the available water is 44.15 tmc at 75% dependability and 52.60 tmc at 50% dependability, for the period of 1965-66 to 1999-2000.

(xlv)

By way of an amended plea the State of Karnataka has referred to a visit of this Tribunal, when it inspected the projects and schemes in the basin States Goa, Maharashtra and Karnataka from 12.12.2013 to

24.12.2013. It maintains that when on 21.12.2013, the Tribunal inspected the Malaprabha reservoir, several farmers submitted memoranda demanding water to mitigate the effect of drought in the areas coming under Drought Prone Area Program (DPAP). These areas are part of taluks of Bailhongal, Ramdurg and Soundatti in the district of Belgaum. The farmers of

440

Malaprabha command area also demanded water to supplement irrigation.

(xlvi)

Karnataka has further stated that the Water Resources Department (i.e. W.R.D.O.) of the Government of Karnataka examined the needs and requirements of the DPAP areas in the taluks of Bailhongal, Ramdurg and Soundatti in the district of Belgaum. The needs of Malaprabha command were also examined. The State of Karnataka has decided to take up the following projects and schemes:

(a)

3.00 tmc of water is to be utilized for protective irrigation in the DPAP area of Ramdurga,

Soundatti and Bailhongal Talukas by Lift Schemes.

(b)

2.00 tmc of water is to be utilized for drinking water and irrigation by recharge of ground water in the DPAP areas of Ramdurga, Soundatti and Bailhongal Talukas.

(c)

2.00 tmc to be utilized for areas in Malaprabha Command which are not getting adequate water

as originally planned as the yield has come down from 44 tmc to 27 tmc. (The Modified Detailed Malaprabha Report of Malaprabha Project was approved by the Central Water Commission on 26.10.2009)

xlvii) According to Karnataka, the above three projects/schemes total up to 7.00 tmc of water. Karnataka submits that the claims made in the original Statement of Claims filed on 02.01.2013 in respect of four projects/schemes mentioned therein, total up to 14.987 tmc, (including 0.4 tmc of evaporation losses at Kotni dam site in MHEP) and adding 7.00 tmc, submitted in this amended Statement of Additional

Claims, the total claims would go up to 21.987 tmc. These claims of 21.987 tmc are well within the total claims of 24.15 tmc of consumptive uses mentioned by Karnataka in the Complaint and the Statement of Claims dated 02.01.2013.

(xlviii) The State of Karnataka pleads that Technical Note appended to the Statement of Claims shows that in Karnataka part of Mahadayi Basin, the yield in the

water year of 1966-1967 was minimum, being 30.102 tmc. But, in the water year of 1994-1995 the yield was maximum, being 82.389 tmc. In 26 out of 35 water years in the series/surplus water, namely water above 44.15 tmc at 75% dependability, is available in the Karnataka part of Mahadayi basin, which varies from 0.26 tmc in 1970-1971 (44.41 tmc - 44.15 tmc), to 38.239 tmc in 1994-1995, (82.389 tmc - 44.15 tmc).

(xlix)

Karnataka maintains that it proposes to draw surplus water available in the Mahadayi basin from the proposed Kotni reservoir planned under Mahadayi Hydro-Electric Project (MHEP). At Kotni site, the total yield has been worked by considering the yield from Kotni catchment, Irti catchment, Bailnadi diversion. The estimation comes to 21.780 tmc at 75% dependability. After leaving 0.40 tmc towards evaporation losses at Kotni Dam, 4 tmc for diversion from Bhandura project, evaporation of 0.022 tmc at

Bhandura Dam and 1.50 tmc towards in basin uses

and 13.437 tmc for power

development at Kotni

Dam, the surplus at 75% dependability comes to 2.421 tmc.

(l)

Karnataka has also pleaded that the study conducted by the Karnataka Neeravari Nigam Limited of the Government of Karnataka, demonstrates that the surplus water, namely water above 19.359 tmc, is available in 27 out of 30 years. The minimum and maximum available surplus water with respect to 75% dependable yield is 2.421 tmc and 35.084 tmc, and with respect to 50% dependable yield it is 8.043 tmc and 35.084 tmc. Out of surplus water available at Kotni on Mahadayi, 7.00 tmc is proposed to be diverted by using carryover capacity of Malaprabha dam. The proposed diversion of 7.00 tmc of surplus water of Mahadayi to Malaprabha would moderate the floods in Goa, and reduce the wastage to sea during monsoon.

(li)

The State of Karnataka, by way of an amended plea submits that out of its total claims of 24.15 tmc of consumptive use of water, 14.987 tmc of water

claimed for four projects/schemes in the Statement of Claims filed on 02.01.2013, would be drawn from dependable flow at 75% dependability, and the remaining 7 tmc of water claimed for three projects/schemes in this Statement of Additional Claims would be diverted from the surplus water at 75% dependability, by utilizing carryover capacity in Malaprabha Dam.

The propositions of law relied upon by the State of Karnataka in support of its case for allocation of 24.15 tmc of consumptive utilisation from the waters of inter-State river Mahadayi and its valley are as follows:

A.

Proposition-1 :The State of Karnataka has competence - both legislative and executive to develop the waters of the Inter-State river Mahadayi and its valley available within its territory by reference to Entry 17 in List II of

Schedule 7 of the Constitution; since, firstly there is no specific declaration made by the Parliament by law with reference to Entry 56 of

List I to Schedule 7 of the Constitution; and secondly, the River Boards Act of 1956 is not applicable as no Board under Sec., 4 has been constituted.

B.

Proposition-2 :Right of a riparian State to develop the waters of an Inter-State river and its valley are subject to the rights of the co-riparian States as enunciated in the opinion in Special Reference No.1 of 1991, reported in 1993 Supp. (I) SCC 96 at para 71-72.

C.

Proposition-3 :The riparian State of Karnataka has a right to construct a project unilaterally without consent or concurrence of the co-riparian State as held in the case of State of Karnataka vs. State of Andhra Pradesh, etc., reported in [2000] 9 SCC 572 at 640.

D.

Proposition-4: Ifa riparian State is "prejudicially affected" by the unilateral action of the co-riparian State, the affected State may enter into a negotiation to settle the dispute by an agreement or seek adjudication by a Tribunal under the provisions of the Act of 1956.

446

E.

Proposition-5 :The burden of proof that the State of Goa is prejudicially affected by any acts or omissions of the co-riparian State of Karnataka is entirely on the State of Goa.

F.

Proposition-6 :Trans-basin diversion of water of an Inter-State river is not illegal.

G.

Proposition-7 :Drinking water has the highest priority among the uses of water as universally accepted [Delhi Water Supply vs. State of Haryana reported in (1996) 2 SCC 572] and recognized by the National Water Policy. The right to drinking water is also a fundamental right guaranteed under Art.

21

of

the

Constitution.

H.

Proposition-8 :A

State

has

a

right

to

development guaranteed by the Constitution

and

if

the

proposed

development

is

incompatible with the obligation to protect

the environment, the issue is resolved on the

basis of Doctrine of Sustainable Development.

The doctrine of sustainable development is the

basis on which the conflict, if any, between the protection to environment and right to development are resolved.

I.

Proposition-9 :The jurisdiction of the Tribunal constituted under the provisions of Sec.4 of the Act of 1956 is circumscribed by the reference made by the Central Government under Sec.5 (1) of the Act of 1956.

J.

Proposition-10 :Having deleted vide letter dated 10.01.2007 the paras 28(iv) and 28(v) of the letter of complaint dated 09.07.2002, Goa is not at all entitled to raise the plea that the Hubli-

Dharwad water supply requirements are or can be met from the locally available water resources or from alternative sources, viz., the Kali, the Bedti, the Ghataprabha, etc. as alleged in paras 28 (iv) and 28(v) of the Complaint.

K.

Proposition-11 :A riparian State is under an obligation to conduct negotiations with the co-riparian State and if it fails to negotiate in a bona fide manner, an adverse inference may be drawn against the State.

448

L.

Proposition-12 :The "in principle" clearance granted by the Union Ministry of Water Resources vide letter dated 30.04.2002 was wrongly placed in abeyance by a letter dated 19.09.2002, in any case the in-principle clearance meets the requirements of the due diligence test.

M.

Proposition 13 :The yield study of the CWC of March 2003: is binding on Goa and in the facts and circumstances of the present case, it has to be taken as the basis for the determination of the shares of the riparian States in the waters of

the Mahadayi river.

43.

It may be appropriate to notice that besides filing its own Statement of Case, the State of Karnataka has also filed reply/replies to the Statement of Case filed originally by State of Goa, or as amended from time to time. Karnataka, while filing the aforesaid reply/replies has specifically stated that it reiterates and maintains its original pleas taken in its own Statement of Case, original or amended, and has specifically denied the various

pleas raised by Goa, in its Statement of Case, and has filed reply to the Goa's case by taking additional pleas, wherever required. In this view of the matter, without any repetition, it would be appropriate for us to notice only such additional pleas, taken by Karnataka, which are not already covered by the pleas taken in its own Statement of Case (original or amended).

Thus, Karnataka has taken the following additional pleas:

(i)

The entire Statement of Claims of Goa and the averments therein are belied by the minutes of the Inter-State meeting held on 10.09.1996, 04.10.1996 and the statement made by the Deputy Chief Minister of Goa in the inter State meeting held on 10.01.2000 appreciating the utility of Kalasa Project as "a good project and it can be beneficial to both the States".

(ii)

The foundation of Goa's case a gainst the planned utilization of Mahadayi water by Karnataka is based on an archaic theory of "natural flow of waters".

(iii) Goa's responsibility to protect the Aquatic Environments cannot justify its demand for *"naturalflow of water".*

(iv) Right to development and protection of environment have to be reconciled and the governing rule is the Doctrine of sustainable development.

(v)

The Precautionary principle pleaded by Goa does not justify its application to the present case. On the other hand, the evidence demonstrates:

(a)

The Environment Impact Assessment (EIA) Report of the National Environmental Engineering Research Institute (NEERI) prepared in 1997 holds that - after the construction of the then proposed project in Karnataka for utilization of 9 tmc of Mahadayi water, the flow regime in Goa during monsoon from June to October would be marginally reduced by 7.35% (difference between average flows "before" the project and "after" the project) and

the

flow

regime during non- monsoon period from November

to May, which is a critical period, would be

considerably increased by 251.29% to the benefit of Goa.

(b)

The said assessment holds good even now for proposed consumptive utilization of 24.5 tmc as the flow regime in Goa during monsoon from June to October would not be materially changed (change would be 12.19% which is the difference between average flows "before" the project and "after" the project in Table 3.5 of the NEERI Report) and flow regime during non-monsoon period from November to May, which is a critical period, would be considerably increased by 243.48% for the benefit of Goa.

(vi) The Mahadayi Hydro Electric Project (MHEP) planned by Karnataka on river Mahadayi on the "run of the river" basis

is not incompatible with sustainable

development

in

Mahadayi basin and it protects the Aquatic Environment

in Goa because the alleged requirement of water for

protection of

Aquatic Environments

in

Goa, coming

under the heads of Salinity Control and Forest Management

is 158 Mcum (5.60 tmc), and 50 Mcum (1.76 tmc)

respectively, totaling 208 Mcum (7.36 tmc); which can all be met from the combination of flows coming from the catchment in Goa and outflows of 500 cusecs per day from the MHEP (500 cusecs x 150 days) totaling 6.50 tmc during the months of January to May.

(vii) Out of its projected requirement of 2674 Mcum (94.40 tmc) of Mahadayi water by Goa, the alleged requirement for Industrial water supply, salinity control, forest management, domestic water supply, etc., is 624 Mcum (22.04 tmc).

(viii) Even out of huge quantity of 2050 Mcum (72.40 tmc) of Mahadayi water planned for irrigation in Goa in its Master Plan, only projects for 951.11 Mcum (33.59 tmc) are identified which includes 888.36 Mcum (31.37 tmc) for

medium irrigation, and 62.75 Mcum (2.22 tmc) for minor irrigation as mentioned in the said Master Plan.

(ix) Out of the quantity of 2258 Mcum (79.74 tmc) of Mahadayi water planned for irrigation and drinking water in Goa, as

per the Master Plan annexed to Statement of Claims of Goa, only in case of 14 projects mentioned at serial Nos. 1, 2, 12, 13, 14, 16, 17, 19, 28, 29, 30, 43, 45 and 49 indicated in Annexure-18, requiring 895.73 Mcum (31.63 tmc) of water, are part of the shared catchment with Karnataka. However, utilization of 95.73 Mcum (31.63 tmc) of Mahadayi water under 14 projects are not prejudicially affected, either individually or collectively, in any manner by the planned utilization of 24.15 tmc (consumptive) of Mahadayi water in Karnataka.

(x)

The planned consumptive utilization of 24.15 tmc of Mahadayi water in Karnataka out of the available water of 199.6 tmc at 75% dependability or 220 tmc at 50% dependability (as estimated by the CWC) would conserve the Aquatic Environments in Goa by moderating the floods.

(xi) After the deletion of paras 28 (iv) and 28 (v) from its Complaint dated 09.07.2002 vide letter dated 10.01.2007 to make it maintainable for the reference under SECTION 5(1)

of the Act of 1956, Goa is estopped from raising the issues by pleading against or questioning the legality of diversion

of 7.56 tmc of water under the ongoing Kalasa Bhanduri project for meeting the drinking water requirement of twin cities of Hubli-Dharwad etc.

(xii) Goa failed to negotiate in a bonafimanner, as required by a State in a federal setup. In this regard Karnataka relies upon the background of the Inter-State negation meetings, which have already been noticed in the earlier portion.

(xiii) Karnataka maintains that Yield in Mahadayi was estimated by the Central Water Commission (CWC) in September 2001, but given in October 2001 which was revisited in March 2003 estimating that the yield in Mahadayi as 5652 Mcum (199.6 tmc) and 6234 Mcum (220 tmc) at 75% and 50% dependability respectively - even then, Goa insisted (has been insisting) on its rigid stand unsupported by any study or material.

(xiv) Karnataka was justified in starting the construction Kalasa Bhanduri project since:

(a)

Goa failed to negotiate in a bonafide manner;

of

455

(b)

the Supreme Court did not pass any restraint order on 28.09.2006 in I. A. 1 of 2006 in O.S. 4 of 2006 filed by Goa; and

(c)

a co-riparian State is not barred from starting unilateral construction or utilization.

(xv) Drinking water requirement has the highest priority, as per the National Water Policy, among the uses of water of an inter-State river and it is held to be a fundamental right under Article 21 of the Constitution.

(xvi) Trans-basin diversions are not illegal and the practice supports transfer of water from the basin, which has surplus water to the basin which is suffering from deficit, particularly for the drinking water needs.

(xvii) Protection of Environment is not independent of equitable apportionment or utilization, but is a factor to be considered.

Karnataka quotes an extraction from a book by Owen

McIntyre titled "Environmental Protection of International

Watercourses under International law", (published by ASHGATE in 2007) by reference to 1997 UN Convention on the Law of the Non- Navigational uses of International Watercourses, which are extracted below (page 116):

"... *factorsconcerned with the environmental protection of international watercourses are included among those listed in Article 6 as 'relevant to equitable and reasonable utilization".*

(xviii) The State of Karnataka does not admit the generalized statement made by Goa with regard to the Western Ghats as having the head waters. Though, direct nexus between rainfall and forest is not fully available with the current scientific information, however, the Western Ghats are known for "their watershed value".

(xix) Karnataka denies that Mahadayi is " *virtuallythe life line for the very sustenance of the State of Goa and its people"* as averred. There are other major rivers like Zuari. Karnataka submits that Mandovi basin covers only 1580 sq. Km. (42.70%) out of total area

remaining

area

of

3702 sq. Km.

The

of 2122 sq. Km. coming under eight

other basins viz., Terakhol, Chapora, Baga, Zuari, Sal, Saleri Talpona and Galgibag in Goa has no dependence on Mahadayi in any manner. Even in respect of the said 1580 sq. Km. the dependence of Goa from the waters of Mahadayi in Karnataka is very little or negligible for its intended use for irrigation, navigation, sustenance of ecology, flora, fauna etc.

(xx) Karnataka specifically denies that Mandovi waters contribute to the navigation to the Panaji and Marma Goa ports; the latter is on Zuari River, which is not a part of Mahadayi basin. It is also denied that water contribution in the so-called second zone will result in submergence. In any case, Karnataka does not admit that submergence or rehabilitation can be a ground for non-

exploitation or non-development of the available water in the so-called second zone of the Mahadayi basin. It is also denied that there will not be any area for rehabilitation purposes. Karnataka submits that the Mandovi river basin has to be taken as whole and cannot be subdivided into zones or sub- regions, based upon so called geographical "utility features. It is further submitted that

such classifications have no basis legal, scientific or otherwise.

Further, the CWC while estimating the yield of the basin has considered the entire basin as one hydrological unit, and estimated the yield as 220 tmc at 50% dependability, and 199.6 tmc at 75% dependability. Goa has been attempting to divide the basin in a manner convenient to its preconceived plans.

Water is a critical component in the socio-economic development of the State.

(xxi) It is specifically denied that Karnataka - "taking undue advantage of the geographical and geological position in which it is placed, will pose and is posing a very serious threat not only to the very sustenance of river / river basin, but (to) the State of Goa and its peoples" as alleged.

It is denied that the entire economic system, as also the ecological wealth in the form of Khazans, mangroves, agriculture, fisheries and navigation, are rendered critically vulnerable. It is denied that the salinity enhancement will

completely alter the river/river-basin profile, thereby

destroying the prospects of agriculture, drinking water potential, etc.

Karnataka submits that Mandovi basin covers only 1580 sq.Km. out of 3702 sq.km. in Goa. The remaining area of 2122 sq.Km. falls under 8 other basins which include Zuari covering 973 sq.km. The economy of Goa is mainly dependent on trade, mining and tourism, which are unaffected or uninfluenced by the Mahadayi waters.

(xxii) Karnataka denies that –

"any reduction in the Mahadayi waters will not only decimate the areas covered by Wildlife Sanctuaries and national parks measuring about 448.5 sq.km., but further will result in decimating the surrounding forests, particularly within the State of Karnataka since the whole belt is one contiguous belt of forests and wilderness".

It is stated that diversion of water from river channels or river course as planned by Karnataka does not affect the

forest and wildlife as alleged.

460

Karnataka submits that the forests sustain by taking advantage of the water in the catchment. It is only that water, which is not absorbed by the vegetation in the forest, trickles down and contributes to the flows in the stream and river channels it is mentioned that even the wildlife, exists and survives mainly on water in the catchment.

In any case, Karnataka submits that the MHEP project planned by it would improve summer flows in the river in the downstream reaches.

It is stated that even in the upstream reaches, the back water in the storage dams would provide respite to the wildlife during summer.

Karnataka therefore submits that the projects planned by it would advance the growth of forest and wildlife.

(xxiii) Karnataka has denied heavily drinking dependent

water

that - "the

upon

entire

region

is

for

River

Mandovi

needs in particular; the town of Valpoi,

Bicholim, Mapusa, Panaji and Ponda are dependent upon

Mandovi / Mahadayi river basin, and the fresh waters

therein for the purpose of drinkin g water”.

According to Karnataka, Goa has admitted that only 42.7% of the total area of Goa is covered by Mahadayi river basin. Karnataka submits that although the catchment area in Karnataka is lesser than the catchment area in Goa, Karnataka contributes about 45 tmc of water annually and therefore, the planned utilisation of water of 24.15 tmc does not, and should not, affect the legitimate needs of Goa in Mahadayi basin.

(xxiv) Karnataka maintains that to treat the Mahadayi basin as a 'water-deficit' basin by Goa is incorrect and unsubstantiated. The State of Karnataka has also expressed strong reservations on the yield calculation by Goa without any expert study. It is thus denied that Mahadayi River/

river basin, is a water deficit basin.

(xxv) Karnataka also denies that there is a long-established fishing occupation also, in this reach of the river, as averred. The dependence of tourism, fishing and industries on the Mandovi waters is not admitted by State of Karnataka. Karnataka submits that none of the requirements of Goa, even if established, really depend upon flows flowing down

from Karnataka and the water generated within the territory of Goa in Mahadayi basin is more than sufficient to meet the said requirements of Goa, even if true.

(xxvi) Karnataka submits that none of the projects planned by it on main river Mahadayi or its tributary would cause any material injury to the rights and interest of Goa.

It is denied that the Mandovi River, Goa's lifeline, faces imminent threat of choking because of reduction in the water flow, siltation and disruption of its ecology due to change in its profile - as a result of the diversion proposed by Karnataka, or that the river would be reduced to a trickle in the summer months.

Karnataka submits that the *"tricklein the river during summer months" is* oneof the existing intra annual behavior / pattern of the river, but not on account of the diversion by Karnataka, because the yield during non-monsoon months is hardly about 2.67% of the monsoon yield in the entire basin. It is submitted that the Mahadayi

River is purely and entirely monsoonal in the flow behaviour.

It is also maintained by Karnataka that there is no nexus, really, between the ecology in Goa and flows from upper catchment in Karnataka. Karnataka submits that in its territory of Mahadayi basin, the yield on the basis of the CWC gauging at Ganjim, is about 50.13 tmc at 50% dependability and 43.87 tmc at 75% dependability.

It is stated that the total yield of the Mahadayi basin is 220 tmc at 50% dependability and 199.6 tmc at 75% dependability and therefore, it is not correct to state that a very large quantity of water that flows down the Mandovi all the year round originates in the stream in Karnataka as alleged. It is also denied that diversion of water in Karnataka as planned would choke the flows in Goa as alleged or at all.

(xxvii) Karnataka has denied that deforestation has inflicted damage to the Western Ghats. It is also denied that 70% of the original habitats of the Western Ghats have been lost. It is further denied that with trans-basin water diversion and hydroelectric projects within the basin, the Mandovi river,

Goa's life-line, faces imminent threat of chocking because of the reduction in water flow, siltation and disruption of

the ecology due to change in the profile - perhaps being even reduced to a trickle in the summer months and possibility of seismic disturbances. Karnataka submits that the seismic disturbances are characterised under Residual Risk which cannot be prevented with or without dams.

(xxviii) Karnataka has denied that this project of diverting water will submerge a vast area amounting to about 3,000 hectares and that most of it will be the thick forested area on Karnataka side of the valley. It has also been denied that these forests will be destroyed and that there will be a drastic change in the ecology of the valley reducing the rainfall, ruining its forests, wildlife and all its natural wealth.

It is denied that Kotni Hydroelectric & diversion project, if gone ahead will submerge 2145 Ha of forests, plus another 330 Ha of forest land for roads; dams, power houses, township, field offices, etc. It is also denied that the villages will be submerged, some completely partially.

It is denied that the forest cover of Belgaum district

would be reduced from 13% to 8%, after releasing the forest land to Mahadayi Diversion and Hydro-electric and some

project. It is denied that there would be any reduction in forest cover and that the same would have considerable effect on the climate-reduction in rainfall, temperature and humidity contributing to global warming.

(xxix) Karnataka submits that the suggestion of the Chairman of the Central Water Commission on 29.05.2001 to Karnataka that it should not take up work pending "completion of studies/clearance from the central agencies" has not been breached or violated by Karnataka. The Hydrological studies by the CWC were completed by estimating the yield in October, 2001 and which was re-looked again at the instance of Goa. The final report on yield study was submitted in March, 2003. Secondly, the Union Ministry for Water Resources granted clearance by letter dated 30.04.2002, after waiting for more than a month for Goa to submit its yield studies, as agreed in the Inter-State meeting held on 27.03.2002. Therefore, when Karnataka started construction on 02.10.2006, it had met both the conditions suggested by the Chairman of the CWC on 29.05.2001. The

fact that the clearance dated 30.04.2002 was placed in "abeyance" does not make the clearance non-existent.

(xxx) Karnataka submits that Mahadayi water is essential for generating power and meeting the drinking water requirement of Hubli-Dharwad twin cities etc. It is submitted that the Malaprabha project, which is a part of Krishna basin is suffering from deficit yield and the planned command in 1970 has been reorganized. It is claimed that the drinking requirement of Hubli-Dharwad etc. depending on Malaprabha water is under severe strain and, therefore, Karnataka has no choice, but to seek for diversion of Mahadayi water before this Hon'ble Tribunal. It is stated that the waters of no other river or basin can meet the requirement of Hubli- Dharwad twin cities etc., except Mahadayi waters.

(xxxi) Karnataka denies that diversion under Kalasa-Bhanduri project for transfer of 7.56 tmc of water to Malaprabha sub basin of Krishna basin to meet the drinking water requirement of twin cities of Hubli-Dharwad etc., "tantamount to annexation of a part of watersheds of water deficient Mahadayi Basin to the water surplus Krishna Basin

rather than a normal diversion of the rivulet". Karnataka maintains that Mahadayi Basin is not a deficient basin.

(xxxii) It is denied that Karnataka has no right to obstruct or divert waters of Interstate River running through its territory. It is submitted that the Goa will not be prejudicially affected by the diversion of waters by Karnataka. It is also submitted that the availability of drinking water in the region of Hubli-Dharwad and adjoining areas is scarce and thus the diversion is needed to meet the requirements of this region.

(xxxiii) Karnataka submits that the doctrine of equitable apportionment is a restriction on the authority of the State derived from Entry 17 of list II of seventh schedule to the Constitution

but

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doctrine

of

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equitable

apportionment is antithesis of natural flow theory or Harmon doctrine and, therefore, no lower riparian State can claim right to natural flows. It is stated that similarly, no upper riparian State can claim right to take all water as propounded by Harmon doctrine. Karnataka submits that all riparian States have right to take water for beneficial

uses based on doctrine of equality of States which is the basic structure of the Constitution.

(xxxiv) Karnataka submits that Goa is not entitled to any of the prayers as made in the Statement of Case:

(a)

Prayer A cannot be granted, since Karnataka has right to divert waters of Mahadayi being a riparian State. The said right is sustained by Entry 17 of list II of the 7th schedule of the Constitution.

(b)

Prayer B cannot be granted since Kalasa Bhanduri project and all other projects planned by Karnataka for utilization of 24.15 tmc are within its equitable share. Goa will not be affected prejudicially, if Karnataka diverts water as planned.

(c)

In response to prayer C, Karnataka submits that this Tribunal may determine equitable shares of States in the waters of Mahadayi. Karnataka claims 24.15 tmc

of consumptive use as its equitable share in the waters of Mahadayi. Karnataka also claims right to divert 7.56 tmc of water to Malaprabha for meeting the drinking water requirement of twin cities of Hubli-

Dharwad etc., as planned. Karnataka further submits that Goa is not entitled raise any objections against Kalasa Bhanduri project specially since it has unilaterally deleted para 28 (iv) and 28 (v) from its complaint dated 09.07.2002.

(xxxv) Karnataka maintains that, in any case, the contention of Goa that Karnataka has ' *'promoted"* sugarcaneand paddy is misleading and incorrect. Sugarcane and paddy was and is not a part of Malaprabha command. In the detailed project report of 1970, the supply of water was planned for dry crops during both rabi and kharif, however, after experiencing the shortage of water, the cropping pattern was reorganized in 2009 and the rabi dry irrigation has been deleted.

It is stated that at present, the Malaprabha command receives water from Malaprabha reservoir only for dry irrigation in kharif season, but the farmers by conjunctive use of water, viz., groundwater and surface water released

for dry irrigation, have been cultivating sugarcane in about 20% of the command area of the Left Bank Canal. Karnataka

also denies that drinking water supplies to Hubli-Dharwad can be made from the Malaprabha reservoir by enforcing *"demand side management".* Karnatakasubmits that it has already reorganized the cropping pattern by denying irrigation in the rabi crop to the farmers, which has created huge unrest among farmers, and, therefore, it is not in public interest to further cut down water for irrigation in the Malaprabha.

(xxxvi) Karnataka maintains that the Kalasa DPR of 2010 provides all material particulars on hydrological aspects and the yield in Kalasa up to the dam site is 2.15 tmc at 75% dependability, as calculated by applying Inglis formula, which is a standard formula. It is stated that for the period of 1991-92 to 1997-98 the river was gauged at inter-connecting canal which is above the proposed Kalasa dam site and the average of the said seven years, show that the discharge in the river is 3.047 tmc at average. It is mentioned that at 75% dependability, the flow at Kalasa dam site works out to 2.59 tmc and this 75% dependable

yield has been arrived at by applying a factor of 0.85 to

3.047 which is derived from 75% dependable yield of 44.15 tmc divided by yield of 51.93 tmc in the State of Karnataka. It is pleaded that the catchment area up to gauge site was 9.8. sq.km; but the catchment area up to the dam is 21.5 sq.km., and, therefore, what has been estimated by Karnataka is much lesser than what the gauged data for seven years indicate.

(xxxvii) The State of Karnataka has also denied that the proposed diversion of water in Karnataka would in any way affect the Bhimgad Wildlife Sanctuary. It is mentioned that the river flows are the net result of rain fall after consumption by flora and fauna in the catchment. It is stated that the water that reaches Mahadayi River is a water that is not consumed by flora and fauna in the catchment and the diversion of water from the river, therefore has no impact on the flora and fauna of the catchment. Hence, the planned utilisation of water by Karnataka would not have any bearing on the flora and fauna of Bhimgad Wildlife Sanctuary or any other Wildlife Sanctuary.

(xxxviii) Karnataka submits that in Bandura DPR 2000, which has been already filed on record , theyield up to the proposed dam site was estimated at 4.136 tmc at 75% dependability , on the following basis:

YIELD COMPUTATION

Annual Rain fall records of Jamagaon Rain Gauge Station:

Sl. No.	Year	Annual Rainfall (mm)	Rainfall in Descending Order
1.	1980	4688.00	6128.10
2.	1981	4353.50	4835.00
3.	1982	N.A.	4688.00
4.	1983	4230.50	4683.30
5.	1984	N.A.	4553.30
6.	1980	N.A.	4353.50
7.	1986	3004.20	4230.50

8.	1987	2445.20	4188.00
9.	1988	4188.00	4182.70
10.	1989	3631.30	3835.60
11.	1990	4683.30	3710.50
12.	1991	4553.30	3631.30 75% De.Yld
13.	1992	3835.60	3004.20
14.	1993	4182.70	2951.40
15.	1994	6128.10	2445.20
16.	1995	2951.40	2283.20
17.	1996	3710.50	
18.	1997	4835.00	
19.	1998	2283.20	

The catchment area for the proposal of only one dam a little down-stream is 32.25 sq. km. i.e., 12.45 sq. miles, whereas the annual rainfall observed at Jamagaon village with 75% dependability is 143 inches.

Yield at 75% dependability:

=

=

=

$$\frac{12.45 \times 5280 \times 5280 \times 143/12}{10^6}$$

4136 Mcumft.

4.136 tmcft.

Hence the proposed dam site is recommended.

It is stated that the above estimation (by catchment area and depth of rainfall) is done by considering the annual rainfall data of Jamgaon rain gauge station obtained from IMD from 1980 to 1998 for the period of 19 years and the rainfall data of Jamgaon rain gauge station from 1983-84 to 1996-97, for a period of 13 years, was relied upon by the

CWC in its yield studies of October 2001, and March 2003.

It is pleaded that though, Goa raised some questions

against the said yield estimation made by the CWC in March

2003, but Goa did not question the authenticity of the rainfall data of Jamgaon rain gauge station in Karnataka.

(xxxix) It is mentioned that earlier, the NWDA in its water balance studies of 1989 had considered rainfall data of Jamgaon raingauge station of 1979-80 to 1985-86, and though, Goa had some reservations against the NWDA yield studies, but Goa had raised no specific objections against Jamgaon rainfall data and therefore, Karnataka submits that rainfall data of Jamgaon raingauge station is an undisputed data, which can be relied upon for estimation of yield. According to Karnataka, the catchment area considered in the Bandura DPR 2000 is 32.25 sq.km, which is based on topo sheets and on the basis of this data of annual rainfall of Jamgaon and catchment area, the yield has been estimated (by catchment area and depth of rainfall) as 4.136 tmc. Karnataka asserts that the said estimation broadly matches with the estimation made by Karnataka (at 75% dependability) and the gross yield of Karnataka is 44.15 tmc (at 75% dependability) for a catchment of 375 Sq.km. It is

averred that on a proportionate catchment area basis, the

yield of the Bandura catchment of 32.25 sq.km, works out to 3.80 tmc, which estimation of yield at 3.80 tmc is on a conservative side and in these circumstances, Karnataka submits that no technical fault can be found in the estimation of yield of 4,136 tmc made in the Bandura DPR 2000. It is stated that a revised project report viz, Bandura DPR 2012 was prepared and the said revised report became necessary because of the cost escalation.

(xl) It is maintained that the DPR of Malaprabha project envisages 0.216 tmc for the drinking water supply to meet part of the existing drinking water requirement of Hubli-Dharwad, however, the estimation of 7.56 tmc of drinking water of Hubli- Dharwad en-route towns and villages as calculated in the Report on the Drinking Water Demand of Hubli- Dharwad and en-route towns and villages, etc., from Malaprabha reservoir is for the year 2046 and, therefore, there is no contradiction or inconsistency as sought to be made out by Goa.

(xli) Karnataka has offered comments with regard to the Opa

water works, stated to be situated 37 km from Panjim, which supplies drinking water of 114 MLD. It is stated that

according to Goa, the present demand is more than 140 MLD and that it has planned to set up water treatment plant at Opa for additional demand of 27 MLD. It is mentioned that Goa has also averred that construction of another water treatment plant at Ganjim for 25 MLD is planned, but these needs are planned up to 2031 AD by considering per capita coverage of 135 LPCD. Karnataka has pointed out that, Goa has also alleged that these requirements would be in jeopardy if Karnataka diverts water in the upstream region. Karnataka submits that the case of Goa is devoid of any merit as the total yield in the Khandepar up to the confluence with Mahadayi (downstream of Ganjim) is 54.30 tmc at 75% dependability,

or 60.50 tmc at 50% dependability and since, Opa is situated on Khandepar near the confluence with Mahadayi, the said yield is the yield of the Opa catchment for all purposes. It is stated that the entire needs of Goa of 192 MLD of water by 2031 (140+27+25), which is equal to 2.47 tmc annually, constitutes a small portion of the total available yield of 54.30 tmc at 75% dependability, in Khandepar River. It is stated that besides, Goa has planned 3 projects on Khandepar river viz., Mayada project for

0.78tmc, Khandepar project for 4.05 tmc and Kharmol project for 0.33 tmc, totaling to 5.16 tmc and Goa has further planned on streams joining Khandepar River for an utilisation of 2.93 tmc whereas Karnataka has planned diversion of 4.425 tmc from the catchment of Khandepar, as a part of its diversion of 5.527 tmc of Mahadayi water to Kali River. Karnataka submits that if all the projected requirements of Goa and Karnataka are added, the total would come to (4.425 tmc + 5.16 tmc + 2.93 tmc + 2.47 tmc) 14.98 tmc against the available water of 54.30 tmc at 75% dependability, and the Khandepar will still have a surplus of (54.30 tmc - 14.98 tmc) 39.32 tmc going as waste to sea.

(xlii) Denying the averments made by Goa, Karnataka maintains and denies that a sizeable area will have to be cleared to accommodate men and machinery and that it will result in damages to forests for the requirement of fire wood towards such work. It is denied that all these activities will seriously disturb and wipe out the wildlife of the area. It is

stated that it is highly imaginative to claim that the wildlife is just concentrated at the places of works. Karnataka

denies that construction of dams as planned would involve extensive excavation as alleged.

(xliii) Karnataka submits that Mahadayi water is essential for generating power and meeting the drinking water requirement of Hubli-Dharwad twin cities etc., and the Malaprabha project, which is a part of Krishna basin is suffering from deficit yield. It is stated that the planned command in 1970 has been reorganized and the drinking requirement of Hubli-Dharwad etc., depending on Malaprabha water is under severe strain, and, therefore, Karnataka has no choice, but to seek for diversion of Mahadayi water.

(xliv) The State of Karnataka submits that the State is within its rights and authority to promote development of industry,

including sugarcane industry, to manufacture sugar for consumption in India or for exporting to other countries, to earn valuable foreign exchange currency and the State of Goa has also promoted sugarcane industries. It is averred that the final regulating authority for starting a sugar

factory is the Central Government, which takes into account the needs and necessity.

It is denied that sugarcane is a water guzzling crop. It is maintained that the real water guzzling crop is paddy, which is extensively cultivated in Goa.

(xlv) While defending the CWC report of the Year 2003, Karnataka reiterates its submissions made in the Statement of Case and further reiterates that Goa has not come out with any substantial points against the yield studies of CWC in October 2001 and March 2003. It is stated that Goa has not submitted its yield studies, despite undertaking to submit such studies during the course of negotiations.

The following pleas have been taken to defend the CWC Report of 2003:

(a)

It is submitted that the methodology followed by CWC in estimating the yield has been explained in the Statement of Claims of Karnataka.

(b)

CWC has commented on the errors in the float observation method used for measurement of the

river discharges at Ganjim. Therefore, the contentions of Goa based on such incorrect reading of the Report are erroneous.

(c)

Karnataka submits that the CWC in its Report of March, 2003 has considered quality of hydrological observations at Ganjim and Collem. According to this Report, in the years prior to 2001, the CWC had used float observation method for measurement of discharge. In this context, CWC has said the figures up to 2000 "may have larger error as compared to current meter observation" adopted after 2001. In order to deal with this error CWC "superimposed G & D curve for the years prior to 2000 and subsequent to 2001" and found that "they do not show any large variation".

(d)

Based on this, CWC concluded that "discharge observation by float observation up to the year 2000

was satisfactory". CWC also observed that " *errorsin the float measurements will tend to cancel each other and on an annual basis may not be significant*"

(e)

Karnataka maintains that it does not agree with Goa that CWC has made a feeble attempt to justify the

errors. Goa has questioned the superimposition of G & D curve of pre-2000 over post- 2000, on the ground that the post-2000 data was of "short period of time" of one or two years. Karnataka does not admit the correctness of this allegation.

(f)

According to Karnataka, since the discharge data at Ganjim measured by Central Water Commission is a part of publication, the data is presumed to be correct.

(g)

Karnataka maintains that CWC estimated the yield of Mahadayi basin in October 2001 and revisited in March 2003 as 199.6 tmc at 75% dependability and 220 tmc at 50% dependability. On the basis of annual yield for the entire basin worked out by CWC, the surplus water (water above the 75% dependable yield) works out to 20.4 tmc (at 50%).

(h)

In the Statement of Claims, Karnataka has worked out yield of Mahadayi up to Ganjim G & D station maintained by CWC (series of 1979-80 to 2010-11), which is 103 tmc at 75% dependability, and 118 tmc at 50% dependability. The available surplus water up to Ganjim works out to 15 tmc (at 50% dependability). In

482

the Statement of Claims, Karnataka has worked out yield of Mahadayi within its territory as 44.15 tmc at 75% dependability, and 52.6 tmc at 50% dependability. The surplus water works out to 8.45 tmc (50% dependability).

(i)

The catchment up to Ganjim is 880 sq.km, and up to the mouth of the river 2032 sq.km. According to Goa, the catchment of 1050 sq.km, out of the total catchment of 2032 sq.kms, or the total catchment of 1580 sq.kms, lying in its territory should be excluded from the estimation of the yield, since the water generated in this coastal belt is of "no use for

consumption"

(j)

Karnataka denies that the water generated in this catchment of 1050 sq.km., which is 51.67% of the total catchment of 2032 sq.km. cannot be utilised by the State of Goa to meet its alleged requirement. Karnataka also denies that the entire water in this catchment of 1050 sq.km. is a part of "tidal reach". It is also denied during high tide, the sea water flows into the river and renders it of no use for consumption.

(k)

Goa has averred that when the river enters estuary phase, the “ *landbecome very flat"* Goa,further states that, in this flat terrain, *"thereare no well-defined drainage paths that bring the water from the rain falling on this land area"* Theflat land in the lower catchment is geologically known as Delta. The flatness occurs due to the silt deposit brought from the upper catchment over millions of years. Karnataka questions this by maintaining as to whether the land in the lower catchment of 1050 sq.km, of Mahadayi basin is a flat land constituting a delta? Karnataka submits that unlike the lower catchments of Cauvery, Krishna and Godavari, the lower catchment of Mahadayi is not at all a flat land.

(l)

Undisputedly, there is no delta in the lower catchment of the Mahadayi basin. The configuration of Mahadayi river basin up to the river mouth is inclined (sloped)

towards the river unlike the Cauvery and Krishna river basins, being deltaic are inclined (slope) towards the sea. The land level in the catchment of 1050 sq.km. (which corresponds to catchment up to 36 km. from the sea is about 10m to 11m as could be seen from L-

SECTION of the river. Thus, the gradient works out to 1 in 3600. However, the gradient of lower catchment in Cauvery lying below Grand Anicut, is 1 in 2000. Similarly, the gradient of lower catchment in Godavari lying below Davaleshwaram anicut and Krishna, lying below Prakasam barrage is 1 in 7650 and 1 in 7630 respectively. Karnataka submits that the topo sheet of the lower catchment of Mahadayi, indicates that river Mahadayi continues as a channel till it drains into sea, whereas, in the rivers having delta, viz., Cauvery, Krishna and Godavari, the main river ends at Grand Anicut, Prakasam barrage and Davaleshwaram Anicut respectively. It is further submitted that the topo sheet indicates that the lower catchment of Mahadayi is blessed with well-defined drainage paths. The rain water enters these drainage paths, finally draining into the main river Mahadayi. It is asserted that it appeared that the State of Goa has mixed up the river gradient with the catchment gradient. In Mahadayi

basin, the catchment gradient is steep.

(m) The State of Karnataka denies that float method is technically not reliable. The State of Karnataka also

strongly denies that the gauge data at Ganjim does not meet the test of consistency check.

(n)

The State of Karnataka also does not admit discrepancy in the discharge data after 2005. The State of Karnataka submits that these contentions raised by the State of Goa are an afterthought.

(o)

The State of Karnataka denies the correctness of the observations made by the authors of the Report of IIT, Bombay, relied upon by Goa. The run off coefficient for catchment up to Ganjim is high because of the steep gradient, lower permeability of the soil and forest land. The river Mahadayi rises at the level of 860 M above MSL. The river bed elevation at Ganjim is 11.50 M above MSL. The distance between the origin at Degaon and Ganjim is 68.5 km. The average slope works out to 1 in 80. The State of Karnataka has also denied that run off coefficient is typically between 35

to 50% as claimed by Goa.

(xlvi) Karnataka denies that diversion under Kalasa-Bhandura project for transfer of 7.56 tmc of water to Malaprabha sub basin of Krishna basin to meet the drinking water

requirement of twin cities of Hubli-Dharwad etc.,
"tantamount to annexation of a part of watersheds of water deficient Mahadayi Basin to the water surplus Krishna Basin rather than a normal diversion of the rivulet" as pleaded. Karnataka maintains that technical study No.93 being the Preliminary Water Balance Study of Mahadayi (Mandovi) basin, July 1989 by NWDA has revealed that Mahadayi is a surplus basin. Thus, Karnataka asserts that Mahadayi basin is indeed a surplus basin and maintains that neither Mahadayi basin is a water deficit basin nor Krishna basin is water surplus basin.

(xlvii) According to Karnataka, Mahadayi basin is indeed a surplus basin as the yield of the basin estimated to be 199.60 tmc at 75% dependability and 220 tmc at 50% dependability as found by the Central Water Commission in its March 2003 study. It is stated that the utilisation of water in Mahadayi is negligible so far and even if all the claims of the States of 124.90 tmc are accepted (Karnataka is not admitting the correctness of the claims of Goa or Maharashtra) there will

be still a large surplus water available in the basin, whereas,

487

Krishna basin is estimated to have 2578 tmc at average and the claims of the States far exceed the said available water.

(xlviii) It is stated by Karnataka that the Malaprabha sub basin has been facing serious shortage of water and though the yield of Malaprabha project was estimated as 47.25 tmc, the same has come down to 27 tmc. The shortage, therefore, is 20 tmc. It is stated that the requirement of Karnataka under Malaprabha project (Malaprabha DPR 1970) was pegged at 44 tmc, but with the declined yield to 27 tmc, the utilisation under the project has suffered a shortage of 17 tmc and, therefore, diversion of water of Mahadayi to Malaprabha is consistent with the practice of transferring water from surplus basin to the deficit area.

44.

In view of the above stated pleadings of the State of Karnataka, the State of Karnataka has prayed to grant reliefs which have been noticed in detail earlier.

488

DETAILED PLEADINGS OF THE STATE OF MAHARASHTRA

45.

After noticing the pleadings of the States of Goa and Karnataka in detail, in the preceding paragraphs, it would now be appropriate to notice the pleadings of the State of Maharashtra made in the: (a) Statement of Case dated January 2, 2013 (Volume 27); (b) Rejoinder dated July 3, 2013 (Volume 1), filed by the State of Maharashtra to the reply filed by the State of Goa, to the Statement of Case filed by the State of Maharashtra; (c) Rejoinder dated July 3, 2013 (Volume 42) filed by the State of Maharashtra, to the reply by the State of Karnataka, to the Statement of Case filed by the State of Maharashtra; (d) Amended Statement of Case filed by the State of Maharashtra on April 2, 2014 (Volume 74); (e) Rejoinder dated July 5, 2014 (Volume 89) filed by the State of Maharashtra, to the reply filed by the State of Goa, to the amended Statement of Case filed by

the State of Maharashtra; (f) Rejoinder dated September 5, 2014 (Volume 90) filed by the State of Maharashtra, to the reply filed by the State of Karnataka, to the amended Statement of Case filed by the State of Maharashtra; (g) Further amended Statement of Case dated April 20, 2015 (Volume 127); (h) Additional rejoinder dated June 29, 2015 (Volume 146) filed by

the State of Maharashtra, to the additional reply filed by the State of Goa, to further amended Statement of case of Maharashtra; and (i) Rejoinder dated June 29, 2015 (Volume 145) filed by the State of Maharashtra, to the reply filed by the State of Karnataka, to the further amended Statement of Case filed by the State of Maharashtra, which are as under:-

A.

Maharashtra starts its pleadings by describing the details of River Mahadayi and giving a background of the facts leading to the dispute.

B.

Maharashtra states that River Mandovi, also known as River Mahadayi in Karnataka, is an inter-State river flowing in the westerly direction having 87 km. long stretch. It is stated that the major part of the river originates in the State of Karnataka, near village Degaon where the stream is called Bhandura nalla and the small streams near another origin are known as Halter nalla, and Kalsa nalla. It is pleaded that Haltar nalla originating in Karnataka enters Maharashtra

territory, and meets Kattika nalla and then continues to flow down to the State of Goa where it meets Valvot River. It is mentioned that Kalsa nalla from Karnataka meets Surla

nalla in the State of Goa and the Bhandura nalla and other streams from Karnataka form Mahadayi River. It is averred that the Surla nalla and Mahadayi together form the Madei river in Goa which drains through Goa territory and finally forms the Mandovi River in the State of Goa. It is mentioned that the small streams contributing to the basin also originate in the Sahyadryi hills in the area known as Konkan Region in the State of Maharashtra.

C.

Maharashtra further describes the origin/consolidation of Mahadayi River by stating that Halter nalla originating in Karnataka enters Maharashtra territory to which Kattika nalla originating at the highest altitude of about 600 mts., joins near village Virdi and in addition to Kattika nalla and Halter nalla, the Vazare nalla

also

originates

in

Maharashtra's territory and flows down to Goa territory forming Dicholi (Bicholim) River at the border between Maharashtra and Goa. Similarly, it is explained that Ambadgaon nalla which originates at an elevation of about 80 mts., in Maharashtra territory, joins Asnode River a tributary of Mapuca River in Goa State and all these nallas

are the tributaries of Mandovi River which ultimately joins the Arabian Sea near Panjim, the capital of State of Goa. From the foregoing description of the Mandovi basin, it is maintained, that it is clear that Maharashtra, Karnataka and Goa are the three riparian States of the Mandovi river basin.

D.

Maharashtra further pleads that State of Karnataka took up projects on this Inter-State river involving diversion outside the river basin and this was objected to by the State of Goa as a result both States held meetings to arrive at mutual settlement, but negotiations between the States failed forcing State of Goa to file O.S. 4 of 2006 in the Supreme Court of India against the State of Karnataka, Maharashtra and Union of India for appointment of a Water Dispute Tribunal for allocation of water. It is stated that the said suit was disposed of in view of the appointment of this Tribunal, vide Notifications dated 16.11.2010 and 11.1.2011.

It is mentioned that during the pendency of the suit,

State of Karnataka filed an affidavit to the effect that

pending the suit, Karnataka would not divert water outside the basin through the said disputed projects.

E.

In order to bring out clearly the Maharashtra's case before this Tribunal the statement of case by it has been divided into following chapters:

Chapter 1- describes the River Mandovi and the basin States, Hydrology of the basin, particularly the drainage contribution of water by each State, population of the basin.

Chapter 2- deals with the available dependable flow of the River Mandovi and its tributaries in order to arrive at a figure of equitable allocation to each State.

Chapter 3- deals with the economic and social needs of Maharashtra through whose territory part of the river Mondovi’s system runs.



Chapter 4- deals with principles of equitable apportionment of the river waters.

493

Chapter 5- deals with the diversion of the waters outside the basin of River Mahadayi into the River Malaprabha and River Kali.

Chapter 6- sets out the reliefs claimed by the State of Maharashtra.

CHAPTER 1

GEOGRAPHY, HYDROLOGY, CULTURABLE AREA AND POPULATION OF THE MAHADAYI/MANDOVI BASIN

(i)

The Table below gives the salient details of the altitude of the streams and rivers described herein above at the origin and the gradient to get an idea of the nature of flow of the run off in the Mandovi river system:

Sl. No.	Name of the tributary	State of origin	Altitude at origin in meters	State of confluence	Approxi-mate Gradient

1	Mahadayi	Karnataka	940	Goa	1:50
2	Surla/Kalsa	Karnataka	840	Goa	1:57
3	Haltar	Karnataka	852	Goa	1:50
4	Ragda	Karnataka	765	Goa	1:52
5	Khandepar/ Dudhsagar	Karnataka	800	Goa	1:97
6	Kattica	Maharashtra	600	Maharashtra	1:7.5

Sl. No.	Name of the tributary	State of origin	Altitude at origin in meters	State of confluence	Approxi-mate Gradient
7	Vazare	Maharashtra	352	Goa	1:30
8	Ambadgaon	Maharashtra	80	Goa	1:50
9	Valvot	Goa	20	Goa	1:315
10	Kotrachi	Goa	740	Goa	1:35
11	Costi	Goa	700	Goa	1:13
12	Mapuca	Goa	35	Goa	1:490
13	Sinkerim	Goa	20	Goa	1:200
14	Kudne	Goa	380	Goa	1:55
15	Mandovi	Goa	30	Goa	1:875

The Table above reveals that the stream or the river

originating in the State of Maharashtra and Karnataka have fairly steep slopes as most of the rivers originate in the Sahyadri hill ranges and rivers originating in the State of Goa have fairly flatter gradient indicating that they are draining comparatively plateau area.

(ii)

According to Maharashtra, the Sahyadri range of hills & Jamboti hills in Karnataka comprising the Western Ghat form the eastern edge of the Mandovi river basin and

contributes largely to the flows of Mandovi River and the Ghats are at varying altitude from about 950 m. to 30 m. in the Karnataka, and from about 600 m. to 80 m. in the Maharashtra, within 20 to 40 km.

(iii) It is stated that the drainage areas have very steep slopes, evergreen forests and heavy rainfall, and thus, the rainfall in this area contributes rapid flows in the Mandovi river basin. It is averred that below the hill slopes the drainage area have moderately steep slopes till it enters in the Goa territory and within the Goa territory the river slopes are gentle.

(iv) According to Maharashtra, the Mandovi river basin is having mostly a seasonal climate and four distinct seasons are noticeable in a year as mentioned below:

- Monsoon, here the rain starts with south west winds. Mainly it rains during four months from June to September, but it often extends to the middle of October.

496

Post Monsoon season from October to mid-December is a fair-weather season with occasional rain. Initially, October heat is felt everywhere from mid-October to mid-November & gradually the weather gets more comfortable till mid-December.

Winter is generally a period of two and half months from mid-December until about end of February.

Summer lasts for 3 to 4 months from March to May/June. The coastal districts experience heavy rains but mild winter. The weather is however, mostly humid throughout the year.

(v)

Maharashtra states that the Mandovi river basin gets most of the rains from south-west monsoon belts which bring about 94 to 98% of the annual rainfall and the post

monsoon rainfall varies between 2 to 4% generally. It is stated that the pre-monsoon rain generally occurs in between April & May and post monsoon rain occurs generally between October to December however, its percentage is low in Mandovi river basin.

(vi) It is mentioned that the day on which rainfall is 25 mm. or more is considered as a rainy day and the number of average annual rainy days in Mandovi river basin is maximum 110 days, whereas fluctuations in rainfall is observed between 20 to 30% in Mandovi river basin.

(vii) It is informed that agro-climatically, the Mandovi river basin has following zones.

- Very high rainfall and lateritic soils zone :This zone having lateritic soil is situated between 0 to 500 mts. above mean sea level and having very heavy rainfall. The rainfall period in this zone exceeds 100 to 110 days and the annual rainfall is between 2000 to 3000 mm. The soil is predominantly of lateritic type derived from basalt. Paddy is the main crop in this area.

- Very high rainfall and non-lateritic soils zone :This is akin to the above mentioned lateritic soils and very heavy rainfall zone in respect of altitude from the sea

level. Red to gray reddish loamy soils devoid of lateritic soils occurred predominantly in this area. Near the river deltas alluvium and saline soil occurs.

Ghat zone :The Sahyadri ranges and the region with altitude varying between 500 to 1500 mts. and average annual rainfall of 2500 to 4000 mm. primarily covers this zone.

(viii) With regard to the Cropping Pattern, Maharashtra maintains that since the rainfall is quite high in the Mandovi basin and the soils are light to medium in texture, the large area grows paddy, finger-millet, vegetables, mango, cashew nuts and the area is famous for exportable produce of mango & cashew nuts. It is stated that though, these are rain fed crops they need irrigation in the beginning for three years whereas coconuts, banana, papaya, chilies, tomato, brinjal, hot weather ground nut etc. give good yields.

(ix) It is mentioned the the National Water Development Agency created by the Union Govt. to assess the availability of surplus water has studied the water availability of Mandovi river basin, and published their study in Technical Study No.93 "Preliminary water balance study of Mahadayi

(Mandovi basin)" in July 1989 and they have analysed the rainfall data from 16 rain gauge stations in and around the

basin. It is pleaded that they have also considered the observed data at Ganjim on the river Madei intercepting 880 sq.km. drainage area and at Collem on the river Khandepar intercepting 117 sq.km. drainage area and it recommended the availability of surface water as 3164 Mm3 at 75% dependability and 5703 Mm3 at 50% dependability.

(x)

Maharashtra has reproduced a comparison of west flowing Terekhol/Tillari basin vis-à-vis Mandovi basin with reference to Maharashtra Water & Irrigation Commission Report of June 1999 as under:

S.No.	Name of basin	Drainage area	Average Annual availability of water	Annual availability per Sq.Km. of drainage area
1. 2.	Terekhol/ Tilari Mandovi	1475 sq.km. 2032 sq.km.	3 4187 Mm 3 *5770 Mm	3 2.84 Mm 3 *2.84 Mm

*On pro rata basis of Terekhol/Tillari basin.

According to Maharashtra, the above comparison will reveal the extent of water which is available in the Mandovi river basin.

(xi) Maharashtra maintains that the NWDA's results are based on about 6 years observed run off data and this data has been used to establish the rainfall run off co- relationship which has been applied to the rainfall data available from 1901-02 to 1985-86, to draw 85 years series from which 75% dependability and 50% dependability figures have been obtained. It is pleaded that since considerable run off data is now available, accurate estimation of the annual availability of water can be assessed by utilizing this data. It is pointed out that the rainfall figures considered by NWDA are from 1901 to 1985, and thereafter, another 27 years have elapsed for which rainfall data, as well as run off data, is available and hence, according to Maharashtra it is necessary to compute the dependable flows in Mandovi River basin by utilizing up to date rainfall and run off data.

(xii) Maharashtra has pleaded that the geomorphology of

Mandovi basin, on the basis of comparison with Tillari, the

adjoining basin, indicates that 70% area of this basin is highly dissected and hilly. 9% is lateritic plateau.

It is mentioned that different types of formation exist in this basin group and at the bottom lie Granite, Gneiss belonging old Archean group, overlain with Gneiss and Schists belonging to Dharwad group, which in term are overlain with multilayer Deccan trap rocks whereas some parts in upper portion have got transformed into lateritic rock and the upper most crust is of alluvium zone. It is pleaded that Alluvium belts are observed along the banks of small stream and rivers and they have limited thickness, and the basin has soil form of lateritic rock to the extent of 34%, alluvium soil 33% and saline soil near the sea shore are 33%.

(xiii) According to Maharashtra, the population in the Mandovi basin part lying in the State of Maharashtra as per 2001 Census and 2011 Census is as given below and the population is further projected to the year 2050 by which time the population of the country is expected to be

stabilized.

S.No.	Particulars	2001 Census	2011 Census	Projected 2050
1.	Urban	--	--	--
2.	Rural	9488	8058	22960
3.	Total	9488	8058	22960

It is maintained that as at present the population census of late has shown migratory approach, however, considering that with the proposed irrigation and industrial growth in the terrain, the P population will not only stabilize but grow in future.

Maharashtra states that Manganese is available in this basin and high quality Granite stone is also found here, therefore, there is a scope in this area for development of mineral based industry. It is stated that similarly, there is a scope of development of orchards and enterprises based thereon due to abundance of water and availability of land.

It is mentioned that there is scope for cultivation of rubber

and sericulture under irrigation.

(xiv) Maharashtra states that the 75% dependability criterion being adopted in project planning is far from scientific and earlier to 1951 the project's planning in old Mumbai province was used to be based on 80 to 92% dependability criteria.

(xv) It is stressed that the Maharashtra Water and Irrigation has observed that a need had arisen to undertake a review of the logic behind the 75% dependability criterion and tnd the veracity of the dependability is to be carried out in the light of criteria of scientific sanctity, tenability and economic stability and these criterias do not lead any basis to the 75% dependability. It is asserted that statistically an average measure will be scientific in case of variables of varying scatter and it will not be an ad-hoc figure, unlike that of 75% dependable quantity.

It is maintained that the Krishna Water Dispute Tribunal has observed that the average flows in the river basin are the maximum utilizable flows whereas the Cauvery Water Dispute Tribunal has also studied this aspect

and permitted 50% dependability flows to be utilized in the

Cauvery Basin. The KWDT recently has permitted utilization of the average flows in the Krishna Basin.

(xvi) Maharashtra states that stream flow data of more than 30 years duration pertinent to number of basins in the country is at hand and the Central Water Commission and the Indian Standard Code recommends the consideration of 40-year rainfall data for the project planning. It is stated that the trend of rainfall variation over a large period indicates variation in the 75% and other dependable flows, but the average flow of the entire series is the reasonable flow for estimation and utilization purposes. Maharashtra asserts that, since average flow is the maximum utilizable flow, this Tribunal should consider the equitable apportionment of the Mandovi river basin flows at both 75% and average dependability. Therefore, it submits that this Tribunal may consider the availability of water resources in the Mandovi river basin, both at 75% and average dependability and permit the use of water by the three riparian states at 75% & average dependability in future.

It is pleaded that the Planning Commission had constituted a task force to prepare the economic development plan for Goa State in May 1981 under the chairmanship of Dr. Swaminathan, Member Planning Commission and in its published report in 1982, the Central Water Commission estimated the average annual yield of the Mandovi Basin, including the yield from the basin areas lying in Maharashtra and Karnataka as 4455 Mcum = 157 tmc.

(xvii) Maharashtra pleads that in the Mandovi River Basin, as at present, there are two gauge and discharge sites maintained by Central Water Commission and it is stated that the first gauge and discharge site is at Ganjim on Madei River (Site No. 25-A) covering the drainage area of 880 sq. km. whereas the other gauge and discharge site is at Collem on the River Khandepar covering the drainage area of 117 sq.km.

(xviii) It is pleaded that the National Water Development Agency had studied the water availability of Mandovi River Basin,

and published its study in technical study No. 93
"Preliminary water
Basin) in July 1989".
balance study of Mahadayi (Mandovi
It is mentioned that while publishing the report, the NWDA has considered the discharge data for 5 years and built the rainfall run off regression for the available rainfall data for the period 1901-02 to 1985-86. It is stated that the NWDA has considered 20 raingauge stations viz. Supa, Khanapur, Panjim, Sanguem, Margao, Quepem, Mapuca, Bicholim, Valpoi, Ponda, Colem, Marmagoa, Kankumbi, Jamagaon, Amagaon, Castlerock, Tilarwadi, Chapoli, Gavali, Jamboti. It is pleaded that the longest rainfall data available then was from year 1901-02 to 1985-86, however, the rainfall data for all the raingauge stations was not available for the above period, and hence, NWDA developed the co-relationship for computing the rainfall data for the period 1901-02 to 1985-86, and after establishing the rainfall run off co-relationship for the 5-

year’s gauge and

discharge data, applied the regression

series for 1901-02

analysis technique to develop the flow

to 1985-86 period, and determined the annual yield as under:

(a)

(b)

(c)

At 75% dependability 3164 Mcum = 112 tmc

At 50% dependability 5703 Mcum = 201 tmc

Average annual yield 5332 Mcum = 188 tmc

However, it is maintained that since the publication of NWDA's studies, almost a period of 27 years has elapsed and additional raingauge data, as well as runoff data, at Ganjim and Colem is now available, therefore considering the entire data, it is necessary to develop a series, and determine the availability of flows at 75%, 50% and average dependability.

(xix) It is maintained that the streams originating in the State of Maharashtra and Karnataka have fairly steep slopes as compared to the Goa State where the river gradients are comparatively flat.

(xx) It is pleaded that the Mandovi River Basin is being gauged by the Central Water Commission at two places viz. Ganjim covering an area of 880 sq.km. and at Collem covering an area of 117 sq.km., and both these river gauging stations are so located that, they do not cover the catchment lying in the Maharashtra territory. Therefore, it is claimed that Maharashtra State is computing the hydrology based on latest information of the rainfall within and around part of Mandovi Basin lying within the territory of the Maharashtra State.

(xxi) It is mentioned that the Govt. of Maharashtra has created an organization viz. Chief Engineer, Planning & Hydrology, since 1996, to have systematic data collection of rainfall, river gauging, hydro meteorological data & analyzing & processing of data of all the river basins lying in Maharashtra State.

It is pleaded that the comparison with adjoining basin studied by Maharashtra Water & Irrigation Commission,

reveals the Maharashtra's estimate of availability in Mandovi basin as 5770 Mcum and based on this estimate,

proportionate yield from Maharashtra territory on average annual basis will be 218 Mcum = 7.71 tmc.

(xxii) Maharashtra maintains that considerable gauge data has been collected by CWC at Ganjim and Collem site in the recent period, and similarly, Anjunem dam is existing in the State of Goa for quite a number of years, and a gauge data of the same would also be available. It is stated that all these data need to be collaborated to determine the 75%, 50% and average annual yield from the entire Mandovi River Basin, in order to make equitable distribution of flows available in Mandovi Basin to the 3 riparian States viz. Maharashtra, Karnataka and Goa.

(xxiii) With regard to its water needs for irrigation, Maharashtra states that the river basin portion lying in the State is covered largely by moderately dense forests and steep hilly slopes and, therefore, the cultivable area is very small compared to the 77 sq.km. catchment lying in the State. It is mentioned that the gross command area in the river basin

of the State has been estimated as 36 sq. km. (3600 Ha), out

of which the Culturable Command Area (CCA) is estimated as 3108 Ha.

It, thus, maintains that as the land potential available is limited, the only alternative left is to increase the production of food and horticultural crops to maximum extent by providing intensive irrigation in the area served by various projects identified in the basin.

xxiv) It is stated that in addition to agriculture in Mandovi river basin part of Maharashtra, the areas in the adjoining Tillari basin, which are left out from the Tillari basin development around Dodamarg, also needs water for agriculture, industrial and drinking purposes.

It is further stated that the Govt. of Maharashtra has undertaken Tillari Intestate Project in the adjoining basin of Mandovi river, and is providing about 340 Mm 3 of water to the State of Goa in Tillari and Mandovi basin, but the agriculturists, the Gram Panchayats, elected representatives and local leaders are pressing hard for providing drinking & irrigation facilities in the area.

It is stated that the

agriculturists and the population which could not get the

water are pursuing to supply water from Mandovi basin in

part of Maharashtra and the additional gross command area left out from Tillari basin, which can be covered by irrigation from the proposed projects in Mandovi river basin, has been determined as 35 sq.km. (3500 Ha), and the CCA is estimated as 3041 Ha.

(xxv) Accordingly, it is maintained that, the Govt. of Maharashtra has administratively approved the Virdi Large Minor Irrigation (L.M.I.) Project, to serve the irrigation needs of the command area below Virdi L.M.I. Project.

The proposed utilisation at Virdi LMI Project is 22.70 Mcum = 0.80 tmc.

(xxvi) It is asserted that the proposal of Virdi L.M.I. Project was discussed in the meeting of Chief Ministers of Maharashtra and Goa on 26.04.2006, and the State of Goa opined that, State of Maharashtra has right to utilize their share in its State, and should go ahead with construction of Virdi Project and State of Goa had no objection to the same.

(xxvii) It is pleaded that the Govt. of Maharashtra vide a letter dated 30.9.2011 sought the survey and investigation for

additional projects, which could be taken in Mandovi Basin for utilisation of its share of waters and accordingly following sites have been identified and survey and investigation for preparing project report is in progress.

S. No.	Project	Catchment area at identified site in sq.km.	Average Annual yield in Mcum.
1.	Virdi (Morachi Rai) M.I.P	19.978	56.74
2.	Virdi - ‘B’ M.I.P	2.44	6.93
3.	Virdi – ‘C’ Bandhara	35.43	100.62
4.	Talekhol M.I.P	1.70	4.83
5.	Dhangarwadi M.I.P	3.62	10.28
6.	Vazare Bandhara	19.02	54.02
7.	Ambadgaon M.I.P	3.02	8.58

(xxviii) It is stated that the total culturable area estimated for providing with irrigation facilities from Mandovi river basin and adjoining Tillari basin in Dodamarg Taluka from the yield available at project sites works out to about 6149 Ha., and the water requirement to serve irrigation needs of the above said area works out to 132.27 Mcum after accounting for irrigation efficiency.

(xxix) It is stated that as no storage has been presently created in part of the Mandovi basin in Maharashtra State and the

agricultural growth and industrial and mining growth suffers from paucity of water especially during January to June and only kharif crops and small area of horticultural crops up to 9% are grown in this area in Maharashtra State. It is mentioned that, therefore the Govt. of Maharashtra has directed to draw the Master Plan to provide water for industrial, mining, drinking and agricultural growth in the area. According to State of Maharashtra, at present, one minor irrigation tank near Virdi is under construction, and survey & investigation for creating storage in the Mandovi basin part has been taken up to identify the storage sites in the area.

(xxx) With regard to its drinking needs, it is stated that the following villages of Maharashtra State fall in Mandovi basin, and the population as per 2011 census has been given as:

S.No.	Name of the village	Population as per 2011 census
1.	Virdi	942

2.	Talekhol	1200

3.	Aie	1656
4.	Vazare	884
5.	Girode	266
6.	Ambadgaon	1117
7.	Matne	1993
	Total	8058

(xxxi) It is further stated that the area un-commanded by the existing Tillari canal system also faces drinking water problem, and water shortage from January to June, and also needs to be provided water from adjoining Mandovi basin in Maharashtra. It is pointed out that the area which depends on water from adjoining Mandovi basin, practices agriculture in 35 sq.km. around Dodamarg, Ambeli, Bambar, Pikule, Usap etc., whereas the industrial growth and mining growth is fast developing around Dodamarg in Sindhudurg District which also depends on water from adjoining

Mandovi basin. It is stated that the population of the

villages located in the Tillari basin which is proposed to be served drinking water from Mandovi basin, is as under:

S.No	Name of the village	Populati-on as per 2011 census
1.	Kasai	3423
2.	Ambeli	623
3.	Zare Bambar	1492
4.	Pikule	1699
5.	Bodade	537
6.	Khokral	477
7.	Usap	1253
	Total	9504

(xxxii) It is pleaded that the population existing as per 2011 census has already been indicated above, and as per the census report of Govt. of India, India's population is likely to

stabilize around year 2050 and hence, the population of area served by part of Mandovi river basin has been determined for the year 2050 as around 50000 souls. It is mentioned that the drinking water need is continuously on

increase ever since the civilization has grown, and with the rapid advancement in infrastructure and technological development accompanied by the agricultural development, the water need is rising, and hence, for the estimation purpose water need at the rate of 200 liters per capita per day has been determined as 3.65 Mcum = .0013 tmc.

(xxxiii) Need for water is further detailed by Maharashtra by stating that few industries have been already developed near village Vazare in the part of Mandovi river basin which require water to be supplied from the proposed storages for industrial purpose. Similarly, industrialization is growing around Dodamarg taluka place, and mining sector is also developing in the area and the water needs for the year 2050, by which industrial belt in the area would be

established, has been considered as 2.10 Mcum.

(xxxiv) Maharashtra pleads that Haltara nalla is a tributary of Mahadayi River which rises in the State of Karnataka and enters the State of Maharashtra near village Virdi and after

flowing for a length of about 6.6 Km in Maharashtra, it enters the State of Goa, and falls into river Valvanti near village Ghoteli.

It is stated that inhabitants of village Virdi in Maharashtra have historically been, and are presently, dependent on the perennial flows of Haltara Nalla for meeting their water needs and similarly, the flora and fauna in that area are also dependent on the flows of Haltara Nalla for their survival.

(xxxv) Maharashtra maintains that the catchment area of Haltara nalla in the State of Karnataka, almost entirely, contributes to the flows in the nalla near village Virdi and major catchment area in Karnataka is proposed to be dammed and diverted by Karnataka near village Chorla and such a diversion would cut off flows from substantial contributing catchment area, and therefore would adversely affect the flows in Haltara Nalla, particularly in the post monsoon season, and more so in summer season. It is averred that

this would jeopardize water supplies to the inhabitants of

Virdi village, and would sound death knell for the flora and fauna, survival of which is dependent on the waters of nalla.

(xxxvi) With regard to water needs of Maharashtra from Mandovi river basin, it is maintained that the agricultural needs of Maharashtra have been assessed vide as 132.27 Mcum = 4. 682 tmc.

(xxxvii) Maharashtra states that the water needs for agriculture, drinking and industrial area in part of Mandovi river and adjoining part of Tillari basin have been determined and the break-up of the proposed utilization is given hereunder:

1) Irrigation needs of Maharashtra

2) Drinking water needs in part of Mandovi1 river basin

3) Drinking water needs in adjoining un-commanded area of Tillari basin

4) Industrial water needs in part of Mandov River basin

5) Industrial water needs in adjoining un-commanded area of Tillari basin

132.27 Mcum

1.65 Mcum

2.00 Mcum

1.00 Mcum

1.10 Mcum

519

6) Provision for future development

7) Evaporation losses 10 %

Grand Total

Say

180.00 Mcum

=

6.37 tmc.

25.00 Mcum

16.30 Mcum

179.32 Mcum

(xxxviii) Maharashtra states that its requirement of water would be for-

1.

2.

3.

4.

5.

6.

7.

8.

9.

Irrigation

Power Generation

Drinking purposes

Industrial purposes

Navigation

Fisheries

Storages

Diversion of water outside basin

Competing priority between -

(i)

(ii)

(iii)

Irrigation vs. Drinking water;

Rural vs. Urban demand;

Irrigation/Power generation vs.

Flood moderation;

520

(iv)

Cost of construction of uses

vs. Maintenance of minimum flow;

(v)

(vi)

(vii)

(viii)

(ix)

Irrigation vs. Fish culture;

Wet crop vs. Aqua culture;

Rice cultivation vs. Irrigated dry crop;

Irrigation vs. Hydropower generation;

Peak demand of Hydropower

generation

Irrigation and;

vs.

Peak demand for

(x)

Tourism vs. Hydropower.

(xxxix)

With regard to sharing of waters of the Inter-State rivers and diversion of water from Inter-State rivers outside the basin, it is pointed out that the Krishna Water Dispute Tribunal held that the diversion of the water of an Inter-State river Krishna outside the basin is legal and the said Tribunal has observed that the diversion of river water to a different water shed for the purposes of irrigation, generation of hydro power, municipal water supply and other beneficial uses may be made some times, and no objection can be raised to this practice merely on the ground that the diversion is from an Inter-State river.

(xl) Maharashtra points out the fact that on 30th April, 2002, the Central Water Commission had granted in-principle clearance to the State of Karnataka, for diversion of 7.56 tmc water to meet the drinking water needs of Hubli/Dharwad and towns and villages en-route, subject to certain conditions, but on 19th September, 2002, the Govt. of India, Ministry of Water Resources, informed the Secretary, Water Resources Department of Karnataka, that in view of the objection of the State of Goa, the in principle clearance granted, was, for the present, placed in abeyance.

(xli) Maharashtra appears to be supporting the diversion of water outside the basin, when it states that the Krishna Water Dispute Tribunal, while making the equitable distribution of Krishna Basin waters, amongst Maharashtra, Karnataka and Andhra Pradesh, had held that any water diverted from other river to
augment supplies in the
Krishna basin would be legal and the other riparian states would be entitled to the proportionate share of such

augmentation.

It is averred that similarly, the Godavari Water Dispute Tribunal had permitted the Andhra Pradesh to divert water from river Godavari near Polavaram Project to Krishna Delta Project of Andhra Pradesh to an extent of 80 tmc and by an agreement, the Maharashtra and Karnataka had been permitted to have an additional share of 14 tmc and 21 tmc respectively in their allocated share of Krishna Basin Waters.

(xlii) Thus, Maharashtra maintains that action of State of Karnataka in diverting waters of Mahadayi/ Mandovi Basin to Malaprabha River in Krishna Basin will entitle the State of Maharashtra to have additional share in the allocated water of Krishna Basin.

Accordingly, this Tribunal has been requested to determine and grant the additional share of Maharashtra in Krishna Basin, from the proposed diversion of 7.56 tmc by the State of

Karnataka,

from

the

water

of

Mahadayi/Mandovi River to Malaprabha River in Krishna

Basin.

523

(xliii) Maharashtra pleads that, similarly, State of Karnataka has requested this Tribunal to consider whether, the State of Karnataka would be justified in diverting waters of the interstate river Mahadayi (Mandovi) and it's valley to the Kali River for augmenting the generation of electricity under the existing Kali Hydro Power Project.

It is, thus, submitted that on the principles enumerated above, the other riparian States are entitled for a share in the power generated by Karnataka, and, therefore, the State of Maharashtra requests this Tribunal to adjudicate and grant a share in the power to the State of Goa and the State of Maharashtra, due to proposed diversion from Mahadayi/Mandovi Basin to Kali Basin.

(xliv) In its amended statement of claim reliefs sought for by the State of Maharashtra are as under:-

(a)

This Tribunal may determine the total availability of waters in the Mandovi River basin and further decide at what dependability (75% or average) it should be

distributed between the parties.

524

(b)

That this Tribunal may determine the share of each State on equitable apportionment of water of the Inter-State River Mandovi.

(c)

That this Tribunal may allocate 180.00 Mcum water to the State of Maharashtra.

(d)

That this Tribunal may determine the share of Maharashtra State as a result of augmentation of waters in Krishna basin, in accordance with the KWDT Award.

(e)

That this Tribunal may determine the share of Maharashtra State in the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of water to Kali Hydro Power Project.

(f)

That in the event of trans-basin diversion being allowed to the State of Karnataka, this Tribunal may direct the State of Karnataka to maintain minimum flows in Haltara nalla in the post monsoon period, so

525

that the sustenance of the inhabitants, flora and fauna in the State of Maharashtra is not jeopardized.

46.

In view of the above stated pleadings of the State of Maharashtra, the State of Maharashtra has claimed reliefs which have been noticed in detail earlier.

REFRAMING/RECASTING OF ISSUES VIDE ORDER DATED 17.07.2015

47.

This Tribunal has noticed in detail, the pleadings of all the party States including the respective prayers made by them. In view of the amended pleadings of the parties, the Tribunal was of the opinion that the issues already framed for determination deserved to be re-framed and/or re-cast. It was the case of the State of Karnataka and also the State of Maharashtra, that certain issues suggested by the State of Goa did not arise for determination by the Tribunal, as they travelled beyond the scope of the reference. However, in view of the

assertion made by the State of Goa, and counter of the same by the State of Karnataka as well as State of Maharashtra, the Tribunal was of the opinion that those issues should be framed for determination, and that it would be open to the State of Karnataka and the State of Maharashtra to contend that those issues travelled beyond the scope of reference and, therefore, the Tribunal should not adjudicate them at all.

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Thus, all the issues arising out of the pleadings of the parties were framed/re-framed/re-cast as under, vide Order dated July 17, 2015: -

1.

Whether the basic data and information essentially required for arriving at most reasonable assessment of water availability of the inter-State river Mahadayi are available?

Whether the State of Goa proves that as the river Mahadayi flows through three sanctuaries, the State of Karnataka and State of Maharashtra

require prior clearance of NBWL in addition to all statutory and other clearances?

Whether it is proved by the State of Goa that Zuari basin is inter-connected with Mahadayi basin through Cumbarjua Canal, which runs in a

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3.

north-south direction and any diversion of waters from river Mahadayi would affect the navigational channel?

4.

Whether the State of Goa proves that the data available at various observation stations, particularly the hydro-meteorological and hydrological observation stations are not reliable and adequate? If not, what are the bare minimum data and information essentially required to be collected for arriving at most reasonable assessment of water availability of the inter-State river Mahadayi?

Whether the State of Goa establishes that after assessing and deducting from the available waters of river Mahadayi required for ecological sustenance of the River valley eternally, specifically giving due consideration of the scientifically predicted global warming, sea level

increase, increased salinity ingress in coastal areas, etc., the share of all the riparian States should be determined on the basis of remainder water available from river Mahadayi?

Whether the State of Goa proves that there was no actual gauging of (a) the river Mahadayi covering the entire basin and at each of the tributaries and (b) rain to assess the complete yield of the river and, the gauge data collected at Ganjim and Collem sites is unreliable?

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6.

528

7.

Whether the State of Goa proves that the water availability assessment of the Inter-State River Mahadayi should be for 75% dependable flow at various points in the basin and at Karnataka's disputed project site?

Whether the water availability assessment of the inter-State river Mahadayi should be made for different depend-abilities as suggested by the States?

Whether the State of Goa proves that appropriate methods for the purpose of determination of the yield are of the river are not employed and traditional methods of determination of yield would not apply in case of Mahadayi?

8.

9.

10. Whether the State of Goa establishes that (a) the

75% and 50% dependable annual runoff in the entire Mandovi River Basin is 4110.79 Mcum (145.05 tmc) and 4632.178 Mcum (163.45 tmc) respectively, (b) the 75% and 50% dependable annual yield is 3081.07 Mcum (108.72 tmc) and 3471.85 Mcum (122.51 tmc) respectively from the entire Mandovi River Basin considering the area of 1523 km 2 [(2032-509) km 2], and (c) the 75% and 50% dependable annual safe yield is 1986.61 Mcum (70.10 tmc) and 2238.58 Mcum (78.99 tmc) respectively from entire Mandovi River Basin considering the area of 982 km 2 [(2032-1050) km 2].

11. Whether the State of Goa establishes that the equitable share of three co-basin States in the quantity of water available from river Mahadayi should be adjudicated after taking into consideration the long term in-basin needs of the three States for the purpose of domestic water supplies, irrigation, hydro-power generation, navigation, pisciculture and environmental project?

12. Whether the State of Goa establishes that on the basis of the master Plan prepared by the Panel of Experts for Mandovi basin area in the State of Goa, the projected water requirement of the State of Goa, by 2051 AD would be 2674 mcum.

13. Whether the State of Goa proves that in basin needs be given priority over any contemplated extra basin diversions?

14. Whether there is any surplus left for extra basin diversions after adequately providing for long

term in basin needs?

15. Whether the State of Goa proves that the length of river Mahadayi is 111 kms with 76 kms in Goa and that the length of the river Mahadayi influenced by tidal effect is 46 kms from the mouth of the river till Ganjem?

16. Whether the State of Goa establishes that with the impact of global warming, saline water boundaries would be subjected to a dual

mechanism of landward push, due to reduced fresh water flow on one hand and increased sea level on the other hand and also impact process of sedimentation if the proposed diversion is affected?

17. Whether the State of Goa establishes that the diversion of water by States of Karnataka and Maharashtra would have a devastating effect on the agriculture of Mhadei River Basin in the State of Goa?

18. Whether the State of Goa establishes that the proposed diversion schemes of the States of Karnataka and Maharashtra will cause severe and irreparable damage and loss to the forests, wildlife, other organic life and bio-diversity stratosphere of the area in the Mhadei basin particularly in the upstream areas and overall ecology of the Mhadei river basin?

19. Whether the State of Goa establishes that the

proposed diversion schemes of the States of Karnataka and Maharashtra would severely result in destruction, exploitation, damage, diversion of habitat from the wildlife sanctuary and also diversion or stoppage of flow of water into and / or outside the wildlife sanctuary etc.?

20. Whether the State of Goa establishes that the proposed diversion by the States of Karnataka and Maharashtra would have severe and irreparable impact and damage on the navigation

in the River Mhadei which in turn would also impact financial, tourism and economic growth of the State of Goa and the nation?

21. Does the State of Goa prove that diversion of any kind by the State of Karnataka and the State of Maharashtra of interstate waters of river Mahadayi by going against the natural flow of water will degrade and adversely impact the ground water flow Pattern, the tributaries and will affect the ecology of the Riparian as well as upper Stream areas?

22. Does the State of Goa prove that the biological hotspot of Western Ghat sustain and help to maintain global equilibrium of temperature and other ecological balance and that such a unique hot spot cannot be lost by permitting diversion of the interstate Mahadayi River water?

23. Whether the State of Goa proves that responsibility of maintaining the flow of water for

aquatic and terrestrial ecology and environment in the Western Ghats in the State of Goa is not the sole the responsibility of the State of Goa and that the other co-riparian State of Karnataka and Maharashtra have an equal responsibility in that regard?

24. Does the State of Goa establish that for the purpose of estimation of water yield at different dependability, an area of 1050 sq. km. (out of

total catchment area of 2032 sq.km.) is required to be excluded?

25. Whether the State of Goa proves that the State of Karnataka and the State of Maharashtra do not have any right, authority or power to divert the waters of river Mahadayi outside the river basin without the concurrence of the State of Goa?

26. Whether it is proved by the State of Goa that no co-basin State can take up any project on an inter-State river without the consent of the riparian State?

27. Whether the State of Goa establishes that specific restraints or restriction be placed on the upstream riparian States with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable share of Mandovi river basin waters?

28. Whether the State of Goa proves that the water allocation from available resources in Malaprabha basin has not been done by the State of Karnataka in accordance with the principles enshrined in the National Water Policy as regards “priority of allocation of water” and considering the basin being the hydrological unit for planning?

29. Whether the State of Goa proves that there is increase in sugarcane cultivation in the Malaprabha Basin from 224 hectares in the year 1979 to 2756 hectares in the year 2012-13 and that the alleged water scarcity in Malaprabha basin is to be attributed to such indiscriminate use of water for irrigation of a water guzzling crop such as sugarcane?

30. Whether the State of Goa proves that the States of Karnataka and Maharashtra cannot undertake the works of the nature proposed, in an inter-state river, without undertaking any study, analysis, whatsoever in order to estimate the adverse effect of such projects on environment, flora, fauna, wildlife, fishing, agricultural activities, aquatic eco-system, within and outside the States of Karnataka and Maharashtra as well as have negative impact on the lower riparian State of Goa, and the flow of water into the inter-

State river?

31. Whether the State of Goa proves that the various projects proposed and or undertaken by the States of Karnataka and Maharashtra require prior permissions under the Environment Protection Act, Forest Conservation Act, Wildlife Protection Act, Investment Clearance from Planning Commission, Permissions from the Central Government, National Board of Wildlife and other necessary permissions?

32. Whether the State of Goa proves that Article 21 of the Constitution of India which is an Injunction against the State clearly specifies the duty on the part of the State of Karnataka and State of Maharashtra to undertake such Environment Studies to ensure protection of Ecological Environment, healthy living of the people likely to be affected within the basins of Mahadayi, inside and outside Karnataka including the riparian States of Goa?

33. Whether the State of Karnataka proves that the water availability assessment of the inter-State river Mahadayi should be for 75% dependable flow?

34. Whether the State of Karnataka establishes that the total available water for allocation amongst the basin States in the inter-State river Mahadayi and its valley is not less than 220 tmc at 50% dependability or 199.6 tmc at 75% dependability

as estimated by the Central Water Commission in its reports of October 2001 and March 2003?

35. Whether the State of Karnataka proves that the total available water from the Mahadayi river basin within the State of Karnataka is 44.15 tmc (1250.19 Mcum) at 75% dependability and 52.60 tmc (1489.52 Mcum) at 50% dependability.

36. Whether the State of Karnataka proves that the total yield at Kotni site (total yield worked by considering the yield from Kotni catchment, Irti

catchment, Bailnadi diversion) is 21.780 tmc at 75% dependability.

37. Whether the State of Karnataka proves that (a) surplus water is available at Kotni site in 27 out of 30 years, (b) the minimum and maximum available surplus water with respect to 75% dependable yield is 2.421 tmc and 35.084 respectively, (c) the minimum and maximum available surplus water with respect to 50% dependable yield is 8.043 tmc and 35.084 tmc respectively, (d) out of surplus water, 7.00 tmc could be diverted by using carryover capacity of Malaprabha dam, and that (e) the diversion of this 7.00 tmc of surplus water would moderate the floods in Goa and reduce the wastage to sea during monsoon.

38. Whether the State of Karnataka establishes that the effect of unequivocal withdrawal of the contentions in para 28(iv) and 28(v) of its

complaint dated 9.7.2002 vide letter dated 10.1.2007 addressed by the State of Goa to the Secretary, Union Ministry of Water Resources, New Delhi bars the State of Goa from objecting to drinking water needs to the twin cities of Hubli-Dharwad, including villages en route etc. (including Kundgol town) from Malaprabha Reservoir?

39. Whether the State of Karnataka establishes that the State of Karnataka is not in a position to meet its Hubli-Dharwad water supply requirements

from locally available water resources as initially contended by the State of Goa and that there are no alternative sources available to the State of Karnataka from which the water supply needs of Hubli-Dharwad could be met?

40. Whether the State of Karnataka proves that it is entitled to utilization of 1.50 tmc of waters of the inter-State river Mahadayi within the Mahadayi basin located in Karnataka for irrigation, drinking purposes and other purposes?

41. Whether the State of Karnataka proves that the assessment of water availability should be made on the basis of water available at Haltar Dam, Kalasa Dam, Kotni Hydro-power Dam, Bail Nadi Dam site, Bhandura Dam site and entire catchment in Karnataka and Ganjim G&D site on main river, Khandepar at Colem G&D site and entire catchment up to mouth of the Sea of Goa in the interstate river Mahadayi and its valley?

42. Whether the State of Karnataka proves that its share in the waters of inter-State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilization?

43. Whether the State of Karnataka proves that out of its total claims of 24.15 tmc of consumptive use of water:

a.

it is entitled to consumptive use and/or diversion of 15.009 tmc of water to be

drawn from flow of 75% dependability (i) through diversion of 7.56 tmc to provide drinking water to Hubli-Dharwad cities under the Kalasa-Bhandura nala projects, (ii) through diversion of 5.527 tmc to Kali basin to augment the flows of Kali for hydro-power generation under Kali Hydro-Electric Project (KHEP), (iii) through utilization of 1.5 tmc for irrigation and drinking water purposes within Mahadayi basin, (iv) by accounting for the evaporation losses of 0.4 tmc from Kotni dam, and (v) by accounting for the evaporation losses of 0.022 tmc from Bhandura dam; and

b.

it is entitled to diversion of 7 tmc of water from the surplus water at 75% dependability outside the Mahadayi basin for irrigation and drinking purposes by

utilizing the carry-over capacity in Malaprabha Dam, and comprising of (i) 3 tmc for protective irrigation in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas by Lift schemes, (ii) 2 tmc for drinking water and irrigation by recharge of ground water in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas, and (iii) 2 tmc for areas in Malaprabha Command which are not getting adequate water as originally planned as the yield has come down from 44 tmc to 27 tmc?

44. Whether the State of Karnataka proves that in addition to its claim of equitable share of 24.15 tmc for consumptive utilization, it is also entitled to non-consumptive use of 13.437 tmc of water for generation of power under Mahadayi Hydro-Electric Project (MHEP) at Kotni?

45. Whether the State of Karnataka proves that the inhabitants of twin city of Hubli-Dharwad, towns and villages have a right to drinking water from the waters of inter-State River Mahadayi diverted under the Kalasa-Bhanduri project? If so, does not such right have a higher priority over other uses of waters of the said rivers?

46. Whether it is proved by the State of Karnataka that drinking water has the highest priority among the uses of water as universally accepted and recognized by the National Water Policy and that the right to drinking water is also a fundamental right guaranteed under Article 21 of

the Constitution?

47. Whether the State of Karnataka proves that:

a.

the State of Karnataka is entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of water every year of the inter-State river Mahadayi to the Malaprabha river in the Krishna basin;

539

b.

the State of Karnataka is justified in diversion of 7 tmc of water outside the Mahadayi basin for irrigation and drinking purposes [(i) 3 tmc for protective irrigation in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas by Lift schemes, (ii) 2 tmc for drinking water and irrigation by recharge of ground water in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas , and (iii) 2 tmc for areas in Malaprabha Command which are not getting adequate water as originally planned as the yield has come down from 44 tmc to 27 tmc]; and

the State of Karnataka is justified in diverting 5.527 tmc of waters of the inter-State river Mahadayi and its valley to the Kali river for augmenting the generation of

electricity under the existing Kali Hydro

Power Project?

c.

48. Whether the State of Karnataka establishes that it has a right to construct a project unilaterally without consent or concurrence of the co-riparian State as held in the case of State of Karnataka v. State of Andhra Pradesh in (2000) 9 SCC 572 at 640?

49. Whether the State of Karnataka proves that the State of Goa has failed to establish that it is or is likely to be affected prejudicially by the diversion

of waters of inter-State river Mahadayi and its valley as proposed by Karnataka?

50. Whether the State of Karnataka proves that navigable part of Mahadayi River in Goa is limited and in any case, such navigation is only during monsoon season?

51. Whether the determination of share of Maharashtra State or any other co-basin State as a result of augmentation of waters in Krishna basin (due to transfer of water from river Mahadayi) should be undertaken while examining the claims of co-basin States?

52. Whether the State of Maharashtra or any other State would be entitled to have share from the additional power that would be generated by the State of Karnataka as a result of augmentation of waters in the Kali basin due to diversion of water to Kali Hydro Power Project?

53. Whether the State of Maharashtra proves that

water availability assessment should be made on the basis of total availability of water in the Mahadayi river basin?

54. Whether the State of Maharashtra proves that considerable gauge data has been collected by CWC at Ganjim and Collem sites and that gauge data at Anjunem dam existing in the State of Goa should be collaborated with CWC data to

determine average annual yield from the entire Mandovi river basin?

55. Whether the State of Maharashtra proves that the contribution of Maharashtra territories to the basin flow of Mahadayi river is 200.006 Mcum at 50% dependability and 171.891 Mcum at 75% dependability.

56. Whether the State of Maharashtra proves that the availability of water in Mahadayi basin is augmented on account of trans-basin diversion from Tillari basin through Tillari Inter-State Project? If so, to what extent?

57. Whether the State of Maharashtra proves that it is entitled to allocation of 180.00 mcm water from total yield of river Mahadayi?

58. Whether the State of Maharashtra proves that it is entitled to divert the water of river Mahadayi outside the basin for meeting projected requirements in Tillari basin?

59. Whether the State of Maharashtra proves that the State of Karnataka should not be allowed to divert waters outside the basin without the consent of the State of Maharashtra and the State of Goa?

60. Whether the State of Maharashtra proves that the diversion of water of Haltara nalla by the State of Karnataka through construction of dam

on Haltara would adversely affect the flows in Haltara Nalla particularly in the post monsoon season and more so in summer season and that this would jeopardize water supplies to the inhabitants of Virdi village and would sound death knell for the flora and fauna, survival of which is dependent on the waters of nalla.

61. Whether the State of Maharashtra proves that the State of Karnataka is not entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of water as claimed by it every years of the inter-State river Mahadayi to the Malaprabha river in the Krishna basin to the prejudice of the existing and contemplated projects of Maharashtra, including the Virdi (Morachi Rai) project?

62. Whether the State of Maharashtra proves that the State of Karnataka is not justified in diverting waters of the inter-State river Mahadayi and its

valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project?

63. Whether the State of Maharashtra proves that its share of power should be determined on the basis of the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of waters to Kali Hydro Power Project?

64. Whether project-wise restrictions should be placed on the storages and utilization of waters of river Mahadayi?

65. Whether storages of projects of upper riparian States should be determined to meet their allocation?

66. Whether the upper riparian States can construct over-the-year storages / carry over storages?

67. Whether there should be clear directions for timely and periodic releases from projects in upper reaches to enable the lower riparian State to realize its allocations or designed success rate of its projects, without affecting success rate of the projects/ allocation of the upper riparian States?

68. Whether any scheme may be framed for conservation of water over and above the allocated shares of the States by constructing reservoirs wherever possible which may be

regulated by a regulatory authority for the benefit of the three riparian States wherever there may be any shortfall?

69. Whether any machinery should be set up to make available and regulate allocation of water to the States concerned or otherwise to implement the decision?

70. What award?

544

ORDER DATED 27.07.2016 PASSED BY THE TRIBUNAL IN IAs.NO. 60 OF 2015 AND 66 OF 2016 FILED BY THE STATE OF KARNARTAKA REJECTING ITS PRAYER TO PERMIT IT TO DIVERT 7 TMC OF WATER

49.

Before oral evidence was led by the party States in support of their respective claims, the State of Karnataka had filed I.A.No. 60 of 2015 on 1 st December, 2015 and I.A. No. 66 of 2016 on 19 th July,2016. In I.A. No. 60 of 2015, the prayer made by the State of Karnataka was to permit it, at its own cost, to lift or pump 7 tmc of water annually from Mahadayi Basin to Malaprabha Basin, during the months of monsoon, as shown in the map at Annexure A1 for meeting the irrigation requirement, drinking water etc., in the drought affected areas in the Malaprabha Basin. The prayer to permit diversion was confined to two years i.e. for the year 2015-16 and 2016-17. For the purpose of making reference to be made at this stage, to the said applications, the Tribunal is of the opinion that pleadings of the parties mentioned therein are not necessary to be reproduced.

However, the reasoning part of the Order date July 27, 2016 by which the above numbered two Interlocotory Applications were disposed of, is extracted herein below:-

“69. This Tribunal has heard the learned senior counsels for the party-States at length and in great detail. This Tribunal has taken into consideration the averments made in the I.A. 60 of 2015, reply thereto filed by the State of Goa, reply of State of Maharashtra, rejoinder filed by the State of Karnataka, sur-rejoinder filed by the State of Goa, I.A. 66 of 2016 by which I.A. 60 of 2015 is amended by the State of Karnataka, reply filed thereto by the State of Goa as well as other documents on record which are relevant for the purpose of deciding the instant application.

70. The contention raised on behalf of the State of Goa that the instant application is not maintainable as it is filed under SECTION 5(2) of the Inter State Rivers Water Disputes Act 1956 which speaks about final decision to be forwarded to the Central Government and therefore I.A.No.60 of 2015 should be dismissed has no substance.

71. It is true that Section 5(2) of the Act of 1956

speaks about forwarding of final decision which may be arrived at by the Tribunal, to the Central Government. However, in the case of Re: Cauvery Water Disputes case 1993 (Supp.) 1 SCC 1996 at Para 97, the Hon'ble Supreme Cou rt has observed as under:

"97 The interim orders passed or reliefs granted by the Tribunal when they are not purely procedural in nature and have to be implemented by the parties to make them effective, are deemed to be a report and a

decision within the meaning of Section 5(2) and (6) of the Act".

72. In view of what is ruled by the Supreme Court, it is difficult for this Tribunal to accept the argument advanced on behalf of the State of Goa that the application could not have been filed under Section 5(2) of the Act of 1956 or that under Section 5(2) of the Act, the Tribunal has no jurisdiction to grant the relief prayed for in I.A. No. 60 of 2015.

73. Even otherwise the Tribunal has inherent jurisdiction to pass interim orders in the interest of justice, if the facts of the case so warrant.

74. Mr. Nadkarni, learned senior counsel for the State of Goa has fairly acceded to the proposition of law that the Tribunal has got jurisdiction to pass interim order if the case is made out. He has however, stated that the present case is not the one where discretion should be exercised in favour of the Karnataka. Nonetheless, the Tribunal is of the opinion

that it has jurisdiction to pass interim order if case is made out to pass such an order.

75. The plea raised by Shri Nadkarni, leaned senior counsel for the State of Goa that in view of the order dated 17.4.2014 passed by the Tribunal the State of Karnataka is barred from filing IA No. 60 of 2015 cannot be entertained.

76. On 17.4.2014 this Tribunal in IA No.1 of 2012 passed an order, the relevant portions of which are extracted below:

“In view of the consensus arrived at between the parties, the following directions are issued:

i) The State of Karnataka is hereby directed that it shall not actually utilize the water or divert the waters under Kalasa-Bhanduri Project till the disputes arising between the three States are finally adjudicated by this Tribunal;

In order to ensure that the water from Mahadayi basin does not get automatically diverted to Malaprabha basin through the inter-connecting canal, which has been partly constructed by the State of Karnataka, the State of Karnataka is directed to plug both the vents of the cut

and cover section of the reach within Mahadayi basin of the inter-connecting canal with a brick masonry embankment, on or before 31.5.2014;

The State of Karnataka is directed to fill up the excavation made along the ridge line (the line separating the Mahadayi and Malaprabha basins) for the purpose of construction of canal, as per the agreed design and specification, to restore the ridge line as was existing prior to the

ii)

iii)

construction of inter-connecting canal, on or before 31.5.2014.

iv)

The State of Karnataka is directed to complete the work of cross drainage for the existing roads/State highway along with the above mentioned works of plugging to avoid likely flooding/pondage, on or before 31.5.2014; and

In order to monitor the works to be undertaken by the State of Karnataka, a team comprising of (a)the Superintending Engineer, in charge of the works from Government of Karnataka (b) an officer of the rank of Superintending Engineer to be nominated by the State of Goa and (c) an officer in the rank of Superintending Engineer to be nominated by the Government of Maharashra is directed to

be constituted immediately and latest by 30.4.2014. The so constituted team shall monitor the works to be undertaken by the State of Karnataka pursuant to the above mentioned directions. The team so constituted is directed to submit an interim report on the progress of works by 15.5.2014 and a final report on the completion of the works by the first week of June 2014 to the Registrar, Mahadayi Water Disputes Tribunal."

v)

549

77. Mr. Fali S. Nariman, learned senior counsel for the State of Karnataka has argued that this order relates to only Kalasa-Bhanduri project and has no connection with the reliefs which are claimed in I.A. 60 OF 2015. An order has to be read as a whole and in a reasonable manner. Prima facie the Tribunal is of the opinion that the above quoted order relates to Kalsa-Bhanduri project and would not bar the State of Karnataka from claiming reliefs which are prayed for in I.A. No. 60 of 2015 or I.A. No. 66 of 2016. Even if it is assumed for the sake of argument that the above quoted order debars or prohibits the State of Karnataka from filing I.A. No. 60 of 2015 and I.A. No. 66 of 2016, or claiming reliefs sought for therein, this Tribunal is inclined to examine the prayers made in I.A. No. 60 of 2015 and I.A. No. 66 of 2016 on merits of the case. The main prayer in I.A. No. 60 of 2015 reads as under:

“Prayer”

Under these circumstances (and since the water lifted as prayed below goes and will continue to go unutilized into the sea), it is humbly submitted that this Hon'ble Tribunal may be pleased to:

(a)

Permit the State of Karnataka, at its own cost, to lift or pump 7 tmc of water annually from Mahadayibasin to Malaprabha basin, during the months of monsoon, as shown in the map in Annexure-A1 for meeting the irrigation requirement,drinking water

requirement, etc. in the drought affected areas in the Malaprabha basin;

(b) Pass any other order or orders as this Hon'ble Tribunal deems fit in the interest of justice and equity.

78. The learned counsel for the State of Goa asserts that the instant application has become infructuous in view of excess rainfall received in North Interior Karnataka and therefore the Application should be accordingly disposed of. It is submitted that the alleged scarcity of rainfall does not prevail as on today which is the main basis for filing IA 60 of 2015 and therefore the same should not be entertained by the Tribunal at all.

79. The State of Goa in para 13 of page 8 and 9 of the sur-rejoinder on behalf of the State of Goa to the rejoinder dated 06.07.2016 filed in I.A. No. 60 of 2015 by the State of Karnataka has referred to the

rainfall data from India Meteorological Department, Meteorological Centre, Bangalurufor the period from 01.06.2016 to 06.07.2016 which indicates that the season's rainfall has been +19% in the State of Karnataka. It has been further stated that even in the Districts of Belagavi, Dharwad and Gadag in which the alleged drought affected villages of Soundatti, Ramdurga, Bailhongal etc., are situated, the rainfall has been +1%, +7% and +12% respectively. The Tribunal has noticed from the weekly weather report of the Government of India, Ministry of Earth Sciences, India

Meteorological Department for the weeks ending 06.07.2016, 13.07.2016 and 20.07.2016 that the average cumulative rainfall from June 01, 2016 upto week ending 06.07.2016 and 20.07.2016 for North Interior Karnataka are +21%, +23% and +11% respectively. The Tribunal also notices that the situation in the previous year i.e. in the year 2015 was -30%, -32% and -38% respectively for the corresponding periods. Therefore, the upto date data of rainfall indicates that the situation in the current year i.e., in 2016 is quite better than that of the corresponding period of previous year.

80. Once the above mentioned datas are taken into consideration, it becomes absolutely clear that there is no shortage of rainfall at all as is pleaded in IA 60 of 2015 and therefore the relief which is quoted above cannot be granted. To thatextent the application has become infructuous. It must be noticed that on account of rainfall above normal being

as noticed above, the ”emergent situation’’, which was alleged to be existing there at the time of filing of IA 60 of 2015, cannot be visualized to exist any more. Therefore, the prayer quoted abovehas become infructuous with the passage of time and intervening circumstances and therefore it is no more available to the State of Karnataka.

81. Further by filing I.A. No. 66 of 2016, the State of Karnataka has amended prayers made in para 11 of I.A. 66 of 2016 to which a detailed reference is made earlier. In view of the substitution of new

prayers, the original prayer made in I.A. 60 of 2015, no longer survives and it is not necessary for this Tribunal to consider the question whether the State of Karnataka is entitled to the prayers claimed in I.A. 60 of 2015. Under the circumstances, the Tribunal proceeds to consider the question as to whether the State of Karnataka is entitled to the substituted prayers. This Tribunal has taken into consideration the averments made in I.A. No. 60 of 2015 also, for the purpose of considering the question whether the substituted prayers should be granted or not.

82. This Tribunal finds that the basis for claiming the above quoted substituted reliefs is the preliminary report of the Karnataka Neerawari Nigam Ltd. titled “TEMPORARY LIFTING OF 7 TMC OF WATER FROM MAHADAYI BASIN TO MALA PRABHA BASIN” which is filed as Annexure A-1 to I.A. No. 60 of 2015. The preliminary report includes the chapter outlining the scheme for temporary lifting of water from three

different locations and another chapter indicating the water availability at the three locations from where the water is proposed to be lifted. The lifting of 7 TMC of water from Mahadayi basin to Malaprabha basin has been proposed as under:

(a)

Lifting of 1.5 TMC from Kalasa Nala at location marked “X’’ to be delivered to Malaprabha river at location marked ‘Y’;

553

(b)

lifting of 4.0 TMC of water from Mahadayi river at location marked ‘X2’ to be delivered to Bhandura Nala at location marked ‘Y - 2’;

lifting of 5.5. TMC of water from Bhandura Nala at location marked ‘X1’ (comprising 4 .0 TMC of water of Mahadayi river lifted at location marked ‘X2’ and 1.5 TMC from Bhandura Nala itself) to be delivered to Malaprabha river at location marked ‘Y1’.

(c)

83. It is mentioned at Para 2 of the said Report that “it is proposed as an interim measure, to lift the water from the partial catchments of Bhandura Nala/Kalasa Nala and Mahadayi river by providing temporary Sumps/Bunds and by pumping water to the natural streams of Malaprabha River to give immediate relief to the drought affected areas under Malaprabha Basin”.

84. This Tribunal vide order dated 3.9.2014 issued following directions to the State of Karnataka:

"…….

(14) The State of Karnataka is directed to produce before this Tribunal the data/information, including the observed hydrological data in its possession, on or before 2.12.2014;

554

(15) The State of Karnataka is directed to undertake a detailed analysis with a view to checking the consistency data and file report on findings of the analysis, on or before 2.12.2014……’

85. In response to above direction the State of Karnataka filed a report “Reporting State of Karnataka’s compliance of the Order dated 3.9.2014” on 1.2.2014. The State of Karnataka produced the following data as detailed at Para 10, pages 12 to 14 of the Report“Reporting State of Karnataka’s Compliance of the order dated 3.9.2014”:

(a)

Observed hydrological data of gauging for the water year 2000-2001 to 2013-14 conducted by WRDO, Government of Karnataka, Chapoli;

Observed hydrological data of gauging conducted by Karnataka Power Corporation Ltd. at Kotni Dam site;

Rainfall data of 20 stations maintained by IMD;

and

Rainfall data of 10 stations maintained by Water

Resources Development Orgnisation,

Government of Karnataka.

(b)

(c)

(d)

86. At Page 26 of I.A. No. 60 of 2015 filed by the State of Karnataka on 1.12.2015 it is stated that "Gague and discharge data on the Kalasa Nala site, intercepting a catchment area of about 9.80 sq. km. as collected by the Government of Karnataka, is available for the period from 1991 to 1997''. However, neither the information about the observed data at Kalasa site was included in the report of State of Karnataka's compliance of the order dated 1.12.2014 nor the data was produced. It is worth noting that there is no reference to the above said data in the "Affidavit of Examination-in-Chief of Professor Ashwani Kumar Gosain" filed by the State of Karnataka on 15.9.2015. Apparently, the above said data has not been used for detailed analysis with a view to checking the consistency of data. Thus, this Tribunal is inclined to conclude that by not producing the gague and discharging datas at the Kalasa Nala site, intercepting catchment area of about 9.80 sq. kilometers, which

were in possession of the State of Karnataka and by not undertaking a detailed analysis with a view to checking consistency of data, the State of Karnataka has not fully complied with the order.

87. The Report of the Karnataka Neeravari Nigam Ltd. is sought to be relied upon for availability of water at the three points after taking into consideration the observed data of Central Water Commission at Ganjim in catchment area proportion and applying annual monsoon rainfall factor in respect of three sites and the average rainfall of Ganjim catchment, which is not in accordance with the statement made by the State of Karnataka to the

effect that the proposal is founded on the admitted case of the State of Goa that the available water is 108.72 TMC at 75% dependability in Malaprabha basin. As the preliminary report of Karnataka Neeravari Nigam Ltd. is not consistent with the admitted facts of the case of the State of Goa and it does not furnish details such as lifting arrangements, conveyance arrangements or design or estimate or likely impact of the proposal on the projects proposed earlier etc., the said report, does not inspire confidence of this Tribunal and therefore this Tribunal is of the opinion that the same cannot be relied upon for the purpose of considering grant or otherwise of the reliefs claimed by way of amendment.

88. The Government of Karnataka through its Statement of Claims and through related documents has claimed that it is entitled for (i) 24.15 TMC of water of river Mahadayi for consumptive use and/or diversion outside basin, and (ii) additional 13.437 TMC

of water for non-consumptive use i.e. for generation of hydro-power under Mahadayi Hydro-electric project at Kotni. The claims of the State of Karnataka in respect of consumptive use of water and/or diversion of water outside basin and non-consumptive use of water are duly reflected in Issues Nos. 42, 43 and 44 of the issues framed for determination which are related to water availability and water utilization for various purposes, within and outside Mahadayi basin. Therefore, it would be very risky and inappropriate on the part of the Triunal to rely upon the preliminary report which is sought to be relied upon by Karnataka

for grant of interim reliefs before the above stated issues are determined and answered.

89. Through I.A. No.60 of 2015 the State of Karnataka has proposed to lift 7 TMC of water from Mahadayi basin to Malaprabha basin. In Para 3 of IA No. 60 of 2015 it is inter alia mentioned as under:

"……..It is made clear that in the event of the State of Karnataka succeeding in establishing its claim inter alia for allocating 7 tmc of surplus water in Mahadayi basin the interim relief herein prayed for will be (if permitted by the Tribunal) duly accounted for and adjusted against the overall claim of 24.15 tmc (consumptive use)"

90. No details worth the name are included in IA No. 60 of 2015 about the above stated adjustments proposed to be made. It has not been indicated as to what modification will have to be incorporated in the issuesnor it is indicated that in what manner, the configuration of other projects, duly identified and

proposed by the State of Karnataka for utilization of Mahadayi water would undergo changes. As a result of the above stated adjustments arising out of the relief sought for through I. A. No. 60 of 2015, the Tribunal is of the opinion that such details should have been furnished and in the absence of such data, the reliefs claimed in I. A. 66 of 2016 cannot be granted.

91. Lifting of 7 tmc of water from Mahadayi basin to Malaprabha basin as proposed through I.A. 60 of 2015 inter alia includes (a) 1.5 TMC from Kalasa Nala

and (b) 1.5 TMC of water from Bhandura Nala. It is not categorically stated whether the proposed lifting of 1.5 TMC of water from Kalasa Nala would be out of 2.15 TMC which constitutes part of Kalasa Bandura Nala Project for utilization of 7.56 TMC of water of Mahadayi basin for drinking purposes. Similarly, it is also not categorically stated whether the lifting of 1.5 TMC of water as proposed from Bhandura Nala would be out 4 TMC of water which constitutes part of Kalasa-Bhandura Nala Project for utilization of 7.56 tmc of water of Mahadayi basin for drinking purposes. From the figures of water availability in the two tributaries namely, Kalasa Nala and Bhandura Nala, it is evident that 1.5 TMC of water from Kalasa Nala and 1.5 TMC of water from Bhandura Nala, as proposed in I.A. 60 of 2015 constitute component of water availability of Kalasa Bhandura Nala Project and that the proposed lifting of water would invariably affect the availability of 7.56 tmc planned for utilization for

drinking purposes through Kalasa-Bhandura Nala Project and that such an arrangement would make changes in the configuration of Kalasa-Bhandura Nala Project including the drinking water requirement for which the Kalasa-Bhandura Nala Project has been planned. This relevant aspect of the matter is neither explained nor clarified in I.A. 60 of 2015 or in I.A. 66 of 2016 and in absence of such explanation and clarification the Tribunal finds it difficult to grant the relief prayed for in I.A. No.66 of 2016.

92. The lifting of 7 tmc of water from Mahadayi basin to Malaprabha basin as proposed through IA-60 of 2015, inter-alia includes transfer of 4 tmc of water

from river Mahadayi to Malaprabha basin. Going by the statement of State of Karnataka in para 3 of I.A. 60 of 2015, as referred to earlier, this would be duly accounted for and adjusted against the overall claim of 24.15 tmc (consumptive use) .As mentioned earlier, in this regard issue No. 43 has been raised by the Tribunal vide Order dated 17.7.2015. What is relevant to notice is that IA-60 of 2015 refers to water at 75% dependability and not the surplus water at 75% dependability regarding which no clarification is offered in the Application at all. At para 3, page “5” of the IA- 60 of 2015, there is mention of “the extraordinary drought situation which is likely to persist in future”. However, the basis for such a conclusion that the extraordinary drought situation is likely to persist in future also is not mentioned nor elaborated.

93. The State of Karnataka has filed a preliminary report titled “TEMPORARY LIFTING OF 7

TMC WATER FROM MAHADAYI BASIN TO MALAPRABHA BASIN" as Annexure – A1 of the I.A. No. 60 of 2015. This preliminary report provides very limited information. From Table 2 on page 28 of I.A. No. 60, it is noticed that the 75% dependable flow at Kalasa Lifting Site (Catchment area - 15.5 sq.km.) is 2.33 tmc. However, on page 22 of the report titled "FURTHER RESPONSE OF THE STATE OF KARNATAKA TO THE BRIEF NOTE HANDED OVER TO TH E HON'BLE TRIBUNAL AT THE HEARING ON 11.2.2014 AND 12.2.2015)" filed by the State of Karnataka on 15.4.2015, the 75% dependable flow at Kalasa dam

site, with catchment area of 15.5 sq.km., is indicated as 2.15TMC. Reasons for variation in the assessed water availability as reported by the State of Karnataka through two different reports are not explained and the inconsistency remains on the record of the case due to which it is difficult to grant thereliefs claimed in IA No. 66 of 2016. From Table-6 on page 32 of IA-60, it is noticed that the 75% dependable flow at Kongla Lifting Site (Catchment Area -39.9 sq. km.) on Mahadayi is 6.19 TMC. As per this information, the 75% dependable flow per unit area works out to be 0.155 TMC per sq. km. However, on page 23 of the report titled “FURTHER RESPONSE OF THE STATE OF KARNATAKA TO THE BRIEF NOTE HANDED OVER TO THE HON’BLE TRIBUNAL AT THE HEARING ON 11.2.2015 (READ WITH ORDERS DATED 3.9.2014 AND 12.2.2015)” filed by the State of Karnataka on 15.4.2015, the 75% dependable flow at Kotni dam site (with Catchment area of 124.4 Sq.km.) is indicated as

17.04 TMC i.e., about 0.137 TMC per sq.km. Reasons for variation in the assessed water availability as reported by the State of Karnataka through two different reports are not explained and contradiction remains glaring. Therefore, the prayers made in the I.A. No. 66 of 2016 cannot be granted.

94. Two important points included in the IA-60 of 2015 for justifying the proposal are:

(a) alleviation of the unanticipated condition by the relief sought; and

drought

(b)

availability of 7 tmc of surplus water for diversion by lifting from Mahadayi basin to Malaprabha basin.

95. This Tribunal notices that the Hydrological analysis of the three tributaries is based on data for the years 1979-80 to 2012-13 only. It is further noticed that the data mentioned on pages 9 and 10 indicates that the annual yield in the year 2015-16 i.e., upto the end of October 2015 is the lowest with 11.417 tmc. However, the reported value of the yield is only part of the total yield for 2015-16 which, otherwise, should be for the period from June 2015 to May 2016. Since the Hydrological analysis for the three tributaries namely; Kalasa Nala, Bhandura Nala and Mahadayi upto Kongla does not include the data for the year 2015-16, the necessary comparison for this year is not possible. Further, from the Table on pages 9 and 10 of the IA-60 of 2015, the Tribunal finds that apart from

the year 2015-16, next two worst years from the view point of lower flows are the years of 2002-03 and 2001-02 with annual inflow of 14.85 TMC and 15.6 TMC respectively. Most interestingly, it is noticed that these two years i.e., 2001-02 and 2002-03, are also two worst years from the view point of lower values of flow in the case of Kalasa Nala and Bhandura Nala. In case of Mahadayi at Kongla, three worst years from the view point of lower flows happen to be 1985-86, 2001-02 and 2002-03. From the above data, it is apparent that Mahadayi basin is also and can also be infuture, under waterstress during the extreme drought situations in Malaprabha basin. In fact,

detailed hydrological analysis should have been undertaken by the State of Karnataka with a view to thoroughly examine all aspects, particularly, the scenario of both at Malaprabha basin and Mahadayi basin being under water stress in the same year before seeking permission of the Tribunal to transfer water from Mahadayi basin to Malaprabha basin. Such an examination would have indicated the efficacy of the proposal in its proper perspective since the sole objective of the proposal is to alleviate the unanticipated drought conditions. As the State of Karnataka has failed to undertake any thorough examination of all aspects of the case, the reliefs claimed in I.A. cannot be granted.

96. At para 4, page 5 of IA-60 of 2015, the State of Karnataka has stated that " the present application is founded on the admitted case of State of Goa that the available water is 108.72 TMC at 75% dependability in the Mahadayi basin for purposes of

the present application only. At para 5(i), page 6 of the IA-60 of 2015, the State of Karnataka mentions that “the total claim of the State of Goa for meeting its entire need viz., irrigation, drinking water, salinity control, forest management and industrial uses, etc., as mentioned in the Master Plan, as well as, in its pleadings, before this Hon’ble Tribunal are about 94.40 TMC projected for the year 2051”. At para 5(iii), page 7 of the IA, Karnataka proceeds to mention that “having regard to the above admitted position, the difference between the total requirement of Goa as of the year 2051 (94.40tmc) and the total availability of the water according to the State of Goa in the

Mahadayi basin (108.72 TMC), works out to 14.32 TMC which is the surplus water or remaining water available for use in the applicant State of Karnataka". If Karnataka proceeds to claim relief on the basis of facts pleaded by the State of Goa then they could not have relied upon the CWC report in order to show that adequate water is available at the three points from where the water is sought to be lifted. As per the CWC report, the availability of the water is to the extent of 199.60 TMC. Whether water in such a large quantity is available or not, cannot be determined at this interim stage and the same issue can be decided only after the parties lead material evidence.

97. No calculations or report indicating that surplus water is available at the three points from where it is sought to be transferred if 108.72 tmc of water is available as pleaded by Goa, are produced before the Tribunal. Therefore, in absence of such a data, it is difficult for the Tribunal to come to the

conclusion that excess water is available at the three points which can be permitted to be lifted as prayed for by the State of Karnataka. Regarding the claims of State of Goa in respect of water availability and project water requirements and the assessment of so called surplus water or remaining water available for use in the applicant State of Karnataka, it is necessary to emphasize that the State of Karnataka has computed the difference between the 75% dependable annual yield (108.72 tmc) and the projected water requirement of 94.4 tmc and has adopted the difference of 14.32 tmc so worked out as the surplus

water or remaining water available for use in the applicant State of Karnataka. Such conclusions and the proposal for allocation of water for transfer outside the Mahadayi basin donot appear to be appropriate to the Tribunal before examination of the issues framed for determination and that too, without taking into account the claims of State of Maharashtra. Further, the so called surplus water of 14.32 tmc would not be available at the proposed point from where water is sought to be lifted since the difference in the 75% dependable annual yield and the projected water requirements relate to the entire Mahadayi basin and not for the cumulative catchment areaof 78.4 square kilometres upto three lifting points. This very vital aspect of the matter is neither considered by the State of Karnataka before submitting an application for interlocutory relief nor the Tribunal has been addressed on the said point at all.

98. What the Tribunal finds is that lifting of

7tmc of water at the three different points by the State of Karnataka in its application would adversely affect the ecology, environment as well as the natural equilibrium in the Mahadayi basin area falling in the State of Karnataka itself as well as the Mahadayi basin area falling further lower down in the State of Goa. This cannot be countenanced by this Tribunal at all under any circumstances, at this interim stage without having any further details. Furthermore, the State of Karnataka has not shown at all by any data whatsoever, as to what would be the effect of such lifting of waters at three points as claimed by them,

further down the stream viz., 3 kms down stream, 5 km. down stream, 10-15 Km. down stream at all. In absence of such data, the reliefs claimed cannot be granted.

99. A bare reading of the newly claimed prayers, makes it evident that the prayer which was claimed in I.A. No. 60 of 2015 stands modified. Through the prayer made in I.A. No. 60 of 2015, permission was sought to lift 7 tmc of water annually, but through revised prayers, pemission has been sought to lift 7 tmc of water during the year 2016-17 and also to lift 7 tmc of water during the year 2017-18 only. Though the prayer made in I.A. No. 60 of 2015, the quantum of water proposed to be lifted was 7 tmc annually, however, in the revised prayers the lifting of water upto, and not exceeding in all 7 tmc of water from Mahadayi basin to Malaprabha basin, is proposed and it is linked to normal inflows in Malaprabha basin which suggests that lifting would be undertaken only in

deficit months and to make up for the shortfall. In the prayer made in the I.A. No. 60 of 2015, there was a specific reference about “meeting the irrigation requirements, drinking water requirements etc., in the drought affected areas in the Malabrapha basin”. However, the revised prayers have no specific mention of “meeting the irrigation requirements, drinking water requirements etc., in the drought affected areas in the Malaprabha basin.

100. “Reason and justification for I.A. No. 60 of 2015” which had been handed over during the course

of arguments, have been later annexed as Annexure-1 to the I.A. No. 66 of 2016. Paragraph (9) of the said Annexure-1 reads as under:-

"9. Accordingly it is requested that in implementation of I. A. 60 of 2015 (filed in December, 2015) the following (proposed) order may be passed:

(i)

State of Karnataka be permitted to draw by lift at the points mentioned in the map enclosed in I.A. 60 (or at any other points as may be indicated) upto and not exceeding in all 7 tmc in every water year (for the years 2016-17 and 2017-18) from Mahadayi basin to the Malaprabha basin indicated in the said map.

(ii) This permission be granted by the Hon'ble Tribunal only if the monthly normal inflows indicated at page 163 of Malaprabha DPR of

2009 (Vol.33(b)) – DPR approved by CWC in October, 2009 are not realized in any months of the year 2016-17 (June to May) or in any months of the water year 2017-18 (June to May);

(iii) It may be clarified that permission to lift in the deficit months (as set out at page 163 of Vol. 33(b)) be granted upto the normal in that month: for example if in July the normal inflow is 9.02 tmc, and if the shortfall by the

end of July, 2016 is 3 tmc the lift be
permitted to the extent of 3 tmc and not
more. Similarly, if in the month of August
where the yield (iflows) is shown as 5.02 tmc
and at the end of August, 2016 the shortfall
(during the years 2016-17 and 2017-18) is of
2 tmc, permission be limited to lift 2 tmc,
not more;

(iv) Liberty may be given to apply to the Hon'ble
Tribunal in case of unforeseen difficulty
and/or exigency."

101. The proposal for lifting of 7 tmc of water from Mahadayi basin to Malaprabha basin is not covered under any of the issues already framed for determination. The pleadings made by Karnataka through I.A. No. 60 of 2015 or through I.A No. 66 of 2016 or through Annex-1 to I.A. 66 of 2016 (Reasons And Justification for I.A. No. 60 of 2015), do not specifically address the matters related to water

availability at three points proposed for lifting of water. Further, there is marked deviation in the approach for water assessment, as stated in I.A. No. 60 and that adopted in the preliminary report of the Karnataka Neeravari Nigam Limited titled “Temporary Lifting Of 7 TMC Of Water From Mahadayi Basin To Malaprabha Basin”. Para 4 of I.A. 60 of 2015 states that the present application of the State of Karnataka is “founded on the admitted case of State of Goa that available water is 108.72 tmc at 75% dependability in the Mahadayi basin (for purposes of the present

Application only)". The Government of Karnataka further states at para 4 as under:-

"…….. The State of Karnataka submits that to the extent of 108.72 tmc, there is no lis or dispute between the party States before this Hon'ble Tribunal. Therefore, it is within the jurisdiction of this Hon'ble Tribuna l to order the interim allocation or apportionment amongst the party States based on the available water as 108.72 tmc".

102. However, in the preliminary report of the Karnataka Neeravari Nigam Limited, the water availability at the three points has been arrived at by using the observed data of Central Water Commission at Ganjim in Catchment area proportion and applying annual monsoon rainfall factor (in respect of three sites and the average rainfall of Ganjim Catchment) which is not in lines with the mention made by the State of Karnataka that the proposal is "founded on the

admitted case of the State of Goa that the available water is 108.72 tmc at 75% dependability in the Mahadayi basin (for the purpose of the present application only)". What is relevant to notice is that the preliminary report of the Karnataka Neeravari Nigam Limited, prima facie, provides limited information in respect of location and hydrology only. The Central Water Commission report relied upon by the State of Karnataka is seriously contested by the State of Goa, which is quite evident from various paragraphs of its reply which runs into 210 pages, without Annexures.

103. It is apparent that the yield in the Mahadayi basin as per the report of CWC is relatively much higher than what is claimed by the State of Goa and in that eventuality there could be adequate water for meeting water demand of various States. Since the fact that water availability in Mahadayi basin at 75% dependability is 199.6 tmc, as reported in CWC Report, is denied by the State of Goa and there being no other material available on record, it would not be prudent on the part of the Tribunal to place reliance on the said report. The preliminary report of the Karnataka Neeravari Nigam Limited title d “Temporary Lifting Of 7 TMC Of Water From Mahadayi Basin to Malaprabha Basin”, which in a sense is based on the C.W.C Report also cannot be relied upon at this stage. What is most relevant to notice is that in the preliminary report of the Karnataka Neeravari Nigam Limited, very limited information in respect of location and hydrology only is given. However, other relevant details such as lifting

arrangements, conveyance arrangements or designs or estimate or likely impact of the proposal downstream the three points from where water is sought to be lifted, effect on other projects proposed earlier, are not furnished at all.

104. It is interesting to note that tmcft, or Tmc ft. or tmc and tmc is the abbreviation for 1,000 million cubic feet of water (1,000,000,000 equivalent to 10 9 equal to 1 billion) which is commonly used in reference to volume of water in a reservoir or river. 1 Tmcft. is equivalent to 28,316,846,592 liters of water. The flow of a cubic meter per second is also known as cumecs

which is a derived SI unit of volumetric flow rate equal to that of a cube with sides of 1 meter in length exchanged or moving each second. It is popularly used for water flow, especially in rivers.

105. Therefore, one has to imagine if this is the volume of 1 tmc of water, what would be the amount of water which is sought to be lifted or pumped, if permission to lift 7 tmc is granted. For lifting total 7 tmc of water at different places and/or points, huge construction, installation of huge pumps etc., will have to be made, for which no details are furnished in the preliminary report of the Karnataka Neeravari Nigam Limited. Further, after 7 tmc of water is permitted to be lifted or pumped, it would necessarily require a deep concrete volute for installation of heavy duty pumps and also require Sumps or Bunds to be constructed, from which later on, the water can be transferred through huge pipes to the tributaries of Malaprabha basin.

106. The learned Counsel for the State of Karnataka has argued that the proposal of lifting of 7 tmc of water does not involve any permanent structure and that only removable/temporary water pumps will be used which can be taken away after monsoon, but such argument does not inspire the confidence of this Tribunal for the reasons mentioned above. In view of the quantum of water proposed to be lifted and site conditions etc., the Tribunal is of the opinion that the operation of lifting of water without suitable permanent structures is not possible. It is not understood as to how construction of bunds across the

river, which is mentioned in the preliminary report titled “Temporary Lifting Of 7 TMC of Water From Mahadayi Basin To Malaprabha Basin” can be regarded as a temporary structure. The construction of any bund across the river would invariably result in storage of water. The arrangement for allowing long distance transfer of water from Mahadayi river to Malaprabha river, or its tributaries, will have to be made which would necessarily require considerable construction works of permanent nature.

107. Before making such huge constructions as mentioned above, no permission, as on date, has been obtained by the State of Karnataka, either under The Water (Prevention and Control of Pollution) Act, 1974 or The Environment (Protection) Act, 1986 or Wild Life Protection Act or Bio Diversity Actor from the Central Government or from the Planning Commission.

108. Volume No. 3 of the record of this Tribunal filed by the State of Goa pertains to I.A. 1 of 2012. In

Annexure P-5 at page 54 of the same Volume, this Tribunal finds a counter affidavit filed on behalf of State of Karnataka to the Applicationfor ex-parte ad interim relief filed by the State of Goa. The said counter affidavit was filed by the Government of Karnataka before the Supreme Court of India on September 27, 2006. It reads as under:

“(vii) Construction will be conditional: The Government of Karnataka will begin construction of the project on 2 nd October, 2006 in the non-forest areas out of non-plan funds i.e., State

Funds – at its own risk and the diversion or utilization under this project would be subject to the outcome of the suit pending before this Hon'ble Court. Further, as submitted above, the Respondent State of Karnataka has no intention to utilize the water actually – without obtaining the clearance under the provisions of Environment Protection Act, 1986."

109. The Tribunal finds that though it was undertaken before the Hon'ble Supreme Court of India that without obtaining the clearances under the provisions of The Environment (Protection) Act, 1986, the water actually will not be utilized, till date no clearances have been obtained by the State of Karnataka under the provisions of the said Act.

110. Further in the case of Goa Foundation Vs. Diksha Holdings Pvt., Ltd., AIR 2001(SC) 184, an objection was raised to theconstruction of a hotel on a plot of land situated in the area of Nagorcem, Palolem

Taluka and Cancona, Goa. It was argued before the Hon'ble Supreme Court that afte r land is allotted, necessary clearances would be obtained under the provisions of Environment (Protection) Act, 1986. Negativing the said contention, the Supreme Court has held that even before allotment of land, proper necessary clearances under the Act of 1986 must be obtained.

111. It is most important at this stage to notice a Judgement delivered by 5 Judge Constitution Bench of Hon'ble Supreme Court of India in the case of State of

573

Karnataka Vs. State of A.P. and others(2000) 9 SCC 572 which has inter alia held in paragraph 53 of the reported judgement as under:-

“So far as sub – issue (b) is concerned, we really do not find any substance in the contention of Mr. Ganguli, the learned Counsel appearing for the State of Andhra Pradesh. Though it may be fully desirable for all the States to know about the developments of the other States but neither the law on the subject requires that a state even for utilization of its own water resources would take the consent of other riparian States in case of an inter-State river. So far as the second part of sub-issue(b) is concerned, the answer is irresistible that the project of each State has to be approved by the Central Government as well as by other statutory authorities and the Planning Commission, but for which a State should not proceed with the construction of such project.

Issues 9(a) and (b) are answered accordingly (emphasis supplied).

112. Therefore, the statement made by the State of Karnataka, in the present case, to the effect that after permission to transfer 7 tmc of water is granted by the Tribunal, necessary clearances/permissions would be obtained under various provisions of different Acts cannot be accepted by the Tribunal. Such a course cannot be permitted to be adopted by the State of Karnataka.

113. It is necessary for the State of Karnataka to obtain relevant clearances under different Acts before seeking lifting or pumping of 7 tmc of water from Mahadayi basin to Malaprabha basin.

114. The order dated 17.04.2014 passed by this Tribunal in I.A. No. 1 of 2012 makes it more than evident that at that stage, the State of Karnataka had completed construction work of the inter connecting canal between Mahadayi basin and Malaprabha basin for diversion of water. This Tribunal further finds that before constructing and completing such a huge inter connecting canal, admittedly, the State of Karnataka had not obtained any permission either under the provisions of the Environment (Protection) Act, 1986 or the Wild Life (Protection) Act, 1972 or Biodiversity Act, 2002 or the Water (Protection and Control of Pollution) Act, 1974, nor obtained any permission either of the Central Government or of the Planning Commission and, therefore, the contention raised by

the State ofKarnataka that appropriate clearances from appropriate authorities under the different provisions of different laws would be obtained by the State of Karnataka after permission is granted by the Tribunal to lift/pump in all 7 TMC of water from Mahadayi basin to Malaphrabha basin, does not inspire the confidence of this Tribunal.

115. The State of Karnataka has categorically stated that the present application of the State of Karnataka is “founded on admitted case of the Stateof

Goa that theavailable water is 108.72 tmc at 75% dependability in the Mahadayi basin (for purposes of the present application only)". However, the Tribunal finds that the studiesin respect of assessment of water availability at 75% dependability at the three points proposed for lifting the water from Mahadayi basin to Malaprabha basin mentioned in the preliminary report of the Karnataka Neeravari Nigam Limited titled "TEMPORARY LIFTING OF 7TMC OF WATER FROM MAHADAYI BASIN TO MALAPRABHA BASIN" is not at all related to available water of 108.72 tmc at 75% dependability in the Mahadayi basin.

116. At para 4 of the Reason And Justification for I.A. No. 60 of 2015, produced as Annexure "A -1 with application for amendment of IA No. 60 of 2015, (I.A. No. 66 of 2016) there is a reference about normal inflows at Malaprabha from June to May". The flow referred to as normal flow is in fact 75% dependable flow as indicated in the modified DPR of Malaprabha

project of 2009.

117. It is observed from the claimed prayers that the suggestion is to transfer water only in the situation when there is shortfall in a month (actual inflow being less than normal inflow) in the Malaprabha reservoir. However, the status about actual inflow in a particular month and the determination whether it is less than the normal or not, will be known only at the end of the month. Thus, the prayer is not practically implementable at all.

118. The vital question that arises for consideration is as to how the transfer of water from any source can be planned and effected on monthly basis unless the scenario is known in advance. This is more so in view of the fact that the averments made in the amending application, clearly indicate that no permanent structure at points is proposed from where the water is to be transferred. As already noticed, in the absence of deep concrete volutes and sumps or Bunds, neither water can be lifted nor transported.

119. The State of Goa at para 5(a) of the reply on behalf of the State of Goa to the Application for amendment as well as Annexure-1 and Annexure-1(Colly) in I.A. No. 60 of 2015 filed by the State of Karnataka, on 22.07.2016 has referred to the report of the National Water Development Agency to plead that Mahadayi is a deficient basin. The State of Karnataka has contested the above-mentioned stand taken by the State of Goa and has referred to report of NWDA

of August, 1989 to show that Mahadayi basin is not a deficient basin. However, the Tribunal finds that the above referred NWDA study or its findings are not directly related to the prayers made either in I.A. No. 60 of 2015 or I.A. No. 66 of 2016 and, therefore, it is not necessary for the Tribunal to go into the details of these aspects at this stage, because the proposal of Karnataka of lifting of 7 tmc of water, is based on admitted case of Goa that water availability at 75% dependability is 108.72 tmc.

120. In the original application the prayer made by the State of Karnataka was for lifting of 7 tmc of water on the ground that the rainfall was scanty in the area. However, now in the modified prayers, the State of Karnataka has indicated the monthly normal inflows, as indicated on page 163 of the Malaprabha DPR of 2009 Volume 33(B), which in turn refers to inflows in Malaprabha reservoir, and has requested that in a given month when the inflow in the Reservoir is less than the normal, then it be permitted to lift such quantity of water, which would normalise inflows in Malaprabha reservoir. The important question which arises for the consideration of the Tribunal is as to what would happen when there is no sufficient or normal rainfall at a given point of time and the State uses the rain water for some other purposes and channelizes the same to some other areas, resulting in a deficiency of inflow in the Malaprabha reservoir. In such circumstances, the State of Karnataka cannot

claim that it is entitled, either to lift or to pump 7 tmc of water at three points situated in Mahadayi basin to normalise the shortfall in inflow to the Malaprabha reservoir. The prayers made in I.A. 66 of 2016, although at first look, appear to be innocuous one but are capable of leading to granting advantage to the State of Karnataka by way of interim measure, which is not appropriate at this stage.

121. It is well known that there are considerable variations in rainfall and consequently in water availability from time to time, as also from one place to other. Obviously, the projected surplus water of 14.32 tmc, as stated in the I.A. No. 60 for the whole basin

comprises of contributions from different parts of the basin. The contribution to the total projected surplus water from catchments upto the three proposed locations for lifting of 7 tmc of water is more relevant. The projection of surplus water in respect of the whole basin will not be a correct indicator for planning of diversion.

122. While responding to the contention of the State of Goa that (a) the filling up of the Malaprabha reservoir has no correlation with the rainfall in Malaprabha basin, and (b)the prayer now made also has nothing to do with the rainfall, the State of Karnataka has submitted on page 74 of I.A. 66 of 2016 as under:

“Karnataka relies on inflow as an index of drought or distress situation in the Malaprabha command area reservoir catchment, because the rainfall by itself cannot and does not give an accurate picture”.

Considering “inflows” as one of the several indices for the entire catchment and/or command area appears to be logical. However considering inflows as the only index and that too restricting it to the “reservoir catchment” is quite unusual. The Manual for Drought Management brought out by the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India in the year 2009 has listed various scientific indices for measuring the

intensity, duration, and spatial extent of drought. This Tribunal notices that there is no specific index known as Inflow index or inflow to reservoir index. However, inflow to reservoir is a component of “Surface Water Supply Index”, which has been defined as under on page 42 of the above stated Manual of Drought Management:

“Surface Water Supply Index

The Surface Water Supply Index (SWSI) integrates reservoir storage, stream flow, and two precipitation types (snow and rain) at high elevations into a single index number. SWSI is relatively easy to calculate and it gives representative measure of water availability across a river basin or selected region/province. It is, however, unlikely that it could be successfully used for large regions with significant spatial hydrological variability: the weights may differ substantially from one part of the region to another”. The Tribunal finds that in “Section 3 - Drought Declaration” of the above

stated Manual, following has been stated:

“On the basis of wide -ranging consultations with the meteorologists and agriculture scientists, rainfall deficiency, the extent of area sown, normalized difference vegetation index and moisture adequacy index are recommended as the four standard monitoring tools which could be applied in combination for drought declaration. Since the information on these indicators and indices are available at the level of Taluka/Tehsil/Block, droughtmay be declared

by the State Government at the level of these administrative units on the basis of observed deficiencies. At least three indicators or index values could be considered for drought declaration. It is recommended that these new standards/ guidelines should replace the present system of drought declaration that is based on rainfall deficiency and reduction in annewari/ paisewari/ girdawari figure. The application of these indicators and indices are discussed in key-indexes 1-4, given in succeeding pages".

The Tribunal finds that "Inflow" or "Inflow to Reservoir" has not been identified as one of the key-indicators/indices for drought declaration. The State of Karnataka has not placed on record any document which mentions about the policy or approved practice of the State of Karnataka or that of the Union Government relating to use of Inflow as an index of

drought. In view of the above, the statement of the State of Karnataka regarding use of inflow as the Index of drought is not found to be convincing at all and cannot be acted upon.

123. The Tribunal further notices that at page 91 of the I.A. No. 66 of 2016, the State of Karnataka has stated as under:-

“The prayer for diversion of 7 TMC as a temporary measure is to meet the deficiency in the Malaprabha reservoir both for irrigation and for drinking water. It is intended for meeting not only the irrigationrequirement of 2TMC but also the drinking water requirement of 2.9 TMC (drawn in the water years 2015-16 from spillways) in the downstream areas.Besides, the Malaprabha reservoir has to be compensated for losing 2.656 TMC (as drawn in the water years 2015-16) to supply of drinking water to Hubli-Dharwad. It is necessary to mention that as a result of supply of 2.656 TMC to Hubli-Dharwad etc., only 5.84 TMC was given for irrigation in water year 2015- 16.”

124. The Tribunal finds that the above-mentioned statement is not consistent at all with what has been stated and particularly with the prayers made in I.A. No. 66 of 2016 filed by the State of Karnataka

which have been quoted in extenso, in the earlier part of the Order.

125. Against the proposal made in the prayers, the statement of the State of Karnataka at page 91 of I.A. No. 66 of 2016 mentions that the prayer for diversion of 7 tmc as a temporary measure is to meet deficiency in the Malaprabha reservoir not only for irrigation requirement of 2 tmc but also the drinking water requirement of 2.9 tmc in the downstream areas. What is relevant to notice is that the prayer of

the State of Karnataka in para 9(ii) at page 22of I.A. No. 66 of 2016 is for permission to be granted by the Tribunal only if the monthly normal inflows indicated at page 163 of Malaprabha DPR of 2009 are not realised in any months of the years 2016-17 (June to May) or in any month of the water year 2017-18 (June to May).

126. However, as mentioned above at page 91 of I.A. No. 66 of 2016, it is stated that Malaprabha reservoir is to be compensated for using about 2.656 tmc as drawn in the water years 2015-16, to supply of drinking water to Hubli-Dharwad meaning thereby the State of Karnataka wants to lift or pump a quantity of water which was found to be deficient in the year 2015-16. Such a course cannot be permitted to be adopted. Such averments are not only contradictory in terms to what has been stated earlier or prayed for, but they have also serious implications which are not taken into consideration by the State of Karnataka.

Thus, no prayer can be granted by the Tribunal on the basis of the averments made on page 91 of the I.A. No. 66 of 2016.

127. Time and again it has been emphasized before the Tribunal that large quantity of water goes into the Sea as wastage and therefore the State of Karnataka should be permitted to lift or pump 7 tmc of water from Mahadayi basin to Malaprabha basin during the months of monsoon. Before considering the case of wastage pleaded by the State of Karnataka, it is necessary to understand anatomy of a river.

128. A river is a large, natural stream of flowing water. Rivers are found on every continent and on nearly every kind of land. Some flow all year round. Others flow seasonally or during wet years. Goa claims that Mahadayi is a monsoon flowing river.

129. The beginning of a river is called its source or headwaters. From its source, a river flows downhill as a small stream. Precipitation and groundwater add to the river's flow. Together a river and its tributaries make up a river system. A river system is also called a drainage basin or watershed. A river's watershed includes the river, all its tributaries and any groundwater resources in the area. The end of a river is its mouth. Here, the river empties into another body of water – a large river, a lake, or the ocean. The flowing water of a river has great power to carve and shape the landscape. The energy of flowing river water comes from the force of gravity, which pulls the water downward. The steeper the slope of a river, the

faster the river moves and the more energy it has. The movement of water in a river is called a current. Little by little, a river tears away rocks and soil along its bed and carries them downstream. The river carves a narrow, V-shaped valley. Rapids and waterfalls are common to rivers, particularly near their sources. Eventually, the river flows to lower land. As the slope of its course flattens, the river cuts less deeply into its bed. At the same time, the river begins to leave behind some of the rocks, sand and other solid material, it collected upstream. This material is called

sediment. Once the sediment is deposited, it is called alluvium. Alluvium may contain a great deal of eroded top soil from upstream and from the banks of its meanders. Because of this, a river deposits very fertile soil on its flood plain. A flood plain is the area next to the river that is subject to flooding. Near the end of its journey, the river slows and may appear to move sluggishly. Where the river meets the ocean or a lake, it may deposit so much sediment that new land, a delta, is formed. Not all rivers have deltas. Rivers have always been important to people. In prehistoric times, people settled along the banks of rivers, where they found fish to eat and water for drinking, cooking and bathing. Later, people learned that the fertile soil along rivers is good for growing crops. The wor ld's first great civilization arose in the fertile flood plains of the Nile in Egypt, the Indus in southern Asia, the Tigris and the Euphrates in the Middle East, and the Huang (Yellow) in China. Centuries later, rivers provided

routes for trade, exploration and settlement. When towns and industries developed, the rushing water of rivers supplied power to operate machinery. Rivers continue to provide transportation routes, water for providedrinking and for irrigating farmland and power for homes and industries.

Rivers are important for many reasons. One of the most important things they do is to carry large quantity of water from the land to the ocean. There, seawater constantly evaporates. The resulting water vapour forms clouds. Clouds carrymoisture over land and release it as precipitation. This fresh water, feeds rivers and smaller streams. The movement of water

between land, ocean, and air is called the water cycle. The water cycle constantly replenishes Earth's supply of freshwater which is essential for almost all living things. Except some few rivers, all rivers ultimately flow into the sea whether it is Arabian Sea or Bay of Bengal etc. Before merging into the sea the water of a river is available for consumptive and non-consumptive uses by the States concerned. Therefore, merging of water of river Mahadayi into the Arabian sea irrespective of its uses, cannot be considered to be wastage of water. The plea of wastage of water may become relevant if surplus water is available. As indicated in the earlier part of this order, this Tribunal has come to the conclusion that the State of Karnataka has failed to establish at this stage that the surplus water is available at the three points from which the water is sought to be transferred to Malaprabha basin if water available is 108.72 tmc at 75% dependability in the Mahadayi basin. For this reason, it is difficult for

the Tribunal to accept the case of Karnataka that water goes into the sea as wastage.

130. The CWC data relied upon by the State of Karnataka is seriously contested by the State of Goa which is quite evident from the averments made in paras 179-B to 179-O of amended Statement of Case filed by the State of Goa on 23.04.2015. In view of such a contest the Tribunal does not find it prudent to place reliance on the CWC Report at this stage while considering the question of grant or otherwise of interim relief to the State of Karnataka.

131. The State of Karnataka has prepared a preliminary report in respect of the present proposal. However, Karnataka has neither prepared nor submitted before this Tribunal, any DPR or technical feasibility study of the present proposal.

132. The State of Goa in its reply to I.A. No. 60 of 2015 filed on 22.07.2016 has in para 28 on page 12 mentioned about the salient features such as length and catchment areas of two tributaries of Malaprabha namely Joul Nalla and Bennehalla Nalla and has claimed that these Nallas have not been tapped by the State of Karnataka to find out whether water can be diverted from these Nallas to Malaprabha reservoir. In this regard, the State of Goa has furnished a copy of the News Report dated 04.10.2015 appearing in the “Times of India”. The State of Karnataka has objected to such a course being adopted by the State of Goa and has stated that the details mentioned in News Report are not accurate. This Tribunal finds that the

above referred to issue is not directly related to the prayers of the State of Karnataka either made in I.A. No. 60 of 2015 or I. A. No. 66 of 2016 and, therefore, it is not necessary for the Tribunal to go into these aspects in detail at this stage.

133. For all the above-stated reasons, I.A. No. 60 of 2015 as well as I.A. No. 66 of 2016 fail and are hereby rejected. The applications accordingly stand disposed of."

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - IV

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – IV

Sl. No.	DESCRIPTION	PAGE NOS
1.	Details of oral evidence led by the Party States	
	🎬 Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa	587 - 593
	🎬 Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka	593 - 698
	🎬 Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka	699 - 756
		757 - 803

587

DETAILS OF ORAL EVIDENCE LED BY THE PARTY STATES

50.

After the framing of issues, all the three-party States were afforded opportunity to lead their respective evidence. Vide an Order dated 17.07.2015, read with two other later Orders dated 01.09.2016 and 29.11.2016, this Tribunal had directed that since one of the important issues involved in this controversy pertains to the availability of water in the Mahadayi basin, therefore, the Parties were directed to produce their respective evidence on that aspect of the matter, by way of examining Hydrological Experts, at the first instance.

51.

Accordingly, the party States produced the Hydrologists, as their respective expert witnesses.

The State of Goa produced Shri Chetan Pandit, AW1, who had retired as a Member (WP&P), CWC and Ex-Officio Additional Secretary to Government of India, on 31-03-2012, a Hydrologist, as an expert witness.

The State of Karnataka produced Prof. Ashwani Kumar Gosain, RW1, a Professor in Civil Engineering at Indian Institute of

Technology, Delhi, as its expert Hydrologist. It also produced Sh. A.K. Bajaj, RW2, a former Chairman of Central Water Commission, as another expert Hydrologist, in support of its case. The State of Maharashtra produced Sh. S.N. Huddar, MW1, who retired in September 2006, from service as the Secretary (CAD), Water Resources Department, Government of Maharashtra, Mumbai, as its expert Hydrologist.

52.

It would be pertinent to note here that the State of Goa, after producing its three other witnesses, namely Sh. Paresh Porob, AW2, Dr. Shamila Monteiro, AW3, and Sh. Rajinder P. Kerkar, AW4, sought to produce Sh. S.T. Nadkarni, AW5, who is employed as Chief Engineer of Water Resources Department and ex-officio Additional Secretary to Government of Goa.

At that stage an objection was raised by the learned Counsel for the State of Karnataka, by stating that the Affidavit filed by the aforesaid witness Sh. S.T. Nadkarni, AW5, revealed that as a matter of fact he had deposed on certain hydrology aspects of the matter and since, as per direction of this Tribunal,

the witnesses deposing on the hydrology aspect of the matter were to be produced at the first instance, before any other evidence was led, the evidence of the said witness, who was a Hydrologist, should not be permitted to be recorded.

Although, the learned Counsel for the State of Goa opposed the aforesaid objection, but this Tribunal, vide an Order dated 23.11.2017, upheld the said objection raised on behalf of the State of Karnataka, but observed that this Tribunal had directed the party States to file affidavit/s as evidence of witness/witnesses dealing with Hydrology, because there are serious disputes between the States regarding availability of

water, but, at no stage, the Tribunal had restricted the Parties from leading any further evidence of any Expert Hydrologist, if the necessity so arose, at any subsequent stage.

Noticing the provisions of Section 9(1) (ba), of the Inter State Water Disputes Act, 1956, that this Tribunal has been specifically vested with the powers that enable it for requisitioning any data, and summon any witness/evidence, which may be necessary for adjudication of the Reference, it was observed that although this Tribunal had not exercised the

aforesaid powers, but when the State of Goa, on its own, had chosen to produce such data, and proposed to examine an expert witness in this regard, this Tribunal would not shut that evidence in any manner. Accordingly, the Tribunal allowed the deposition of AW-5 Shri Subrai T. Nadkarni to be recorded, and also ordered that the affidavit dated 14.11.2017 filed by him as Examination-in-Chief, would be so read.

However, to be equitable and fair to the opposite side, the Tribunal, also granted a liberty to the State of Karnataka, as well as to the State of Maharashtra, to examine any further expert witness on Hydrology, if so desired. It was also clarified that if any of the two States chose to re-examine any one of the expert witnesses on Hydrology, already so examined, it might do so, as well.

53.

Besides the aforesaid expert Hydrologists, as expert witnesses, all the three-party States, further, examined other witnesses also, but no other witness on Hydrology was examined either by State of Karnataka or by State of Maharashtra, though

opportunity to examine such a witness was granted as stated earlier.

591

54.

The State of Goa examined three more witnesses, namely, Sh Paresh Porob, as AW2, In-charge Zoo Manager, Bondla Zoological Park, Goa Forest Department of Government of Goa; Dr. (Mrs) Shamila Monteiro, as AW3, who was holding the posts of the Director in the Directorate of Fisheries, Government of Goa from 01.04.2013 to 26.09.2017; Sh. Rajinder P. Kerkar as AW4, who stated that he was working for the awareness of environment, wildlife and forest related issues in the state of Goa and border area since the period of the last more than a quarter century. As already noticed above, Sh. S.T. Nadkarni, Chief Engineer of Water Resources Department and ex-officio Additional Secretary to Government of Goa, was examined as AW5, and was treated as an expert Hydrologist, by this Tribunal.

55.

The State of Karnataka, besides the two expert Hydrologists, as noted earlier, produced Sh. S.M. Jamdar, RW3, who is a retired Indian Administrative Services Officer, having

worked in various capacities in the State of Karnataka and was also the Managing Director of Karnataka Power Corporation Limited, and had retired from the Indian Administrative Service in 2012, as Principal Secretary to the Government of Karnataka in

the Home Department. Further, Karnataka produced Shri G.M. Madegowda, RW4, who is a retired Chief Engineer of the State of Karnataka, and had worked as Chief Engineer, KUWS & DB at Bengaluru and Mysuru, from April 2016 to December 2016.

56.

Similarly, the State of Maharashtra, besides producing its hydrology expert witness, Shri S.N. Huddar as MW1, also produced Shri B.C. Kunjir, MW2, who was working with the State of Maharashtra in its engineering service, Maharashtra Service of Engineers, (MSE) and over the period of time, worked in various capacities. It is stated that he worked as Executive Director, which is equivalent to a Departmental Secretary of Government of Maharashtra, and also is stated to have worked as Chairman and Member of various committees constituted by the State Government of Maharashtra to look into specific issues in Water Resources and Development Projects. Thus, the State of Maharashtra has produced this witness MW2 as an expert witness.

593

57.

At this stage it would be appropriate to enumerate the relevant contents of the statements of the various witnesses produced by the party States.

58.

As noted above, at the first instance, all the three-party States produced the Hydrologists, as their respective expert witnesses, except Goa, which, produced Shri S.T. Nadkarni, as an expert Hydrologist, later on, after permission in that regard was granted by this Tribunal.

Oral evidence of AW-1 Shri Chetan Pandit for the State of Goa

59.

Shri Chetan Pandit deposing as an Expert witness on behalf of the State of Goa filed his first Affidavit-in-Evidence on 15.09.2015 (Volume 165), as AW-1.

60.

In para 2 of his Affidavit, Shri Chetan Pandit has stated that he is deposing limited to the part of hydrology evidence, more particularly, the aspect of water availability in river

Mandovi, also known as Mahadayi. In paragraphs 3 to 10 of his Affidavit, the witness has claimed that he holds a Master's degree in Hydrology and has enumerated his qualifications and

experience, as according to him, in order to plan the utilization of water in a basin it is first necessary to make an assessment of the water availability in that basin. After mentioning that the rainfall is neither uniformly distributed in space nor is consistent in time, it is stated that within a catchment, the rainfall in some areas may be relatively more as compared to some other areas in the same catchment, and in some years it is less than average, and therefore the flow in the river also varies from year to year. In paragraph 13 of his Affidavit he has pointed out certain practical difficulties in the measurement of rainfall and river flow, and that the catchment areas are invariably very large extending over thousands of square kilometres, but the raingauge measures rainfall only at a point and therefore there is no escape from having to accept the measurement at a point as representative of the measurement over a large area. The witness has further explained in paragraph 15 of his Affidavit that assessment of the annual flow in the river is also a complex process and it cannot be measured directly and can only be estimated or assessed by indirect means and the hydrologist making such estimation has to

make certain decisions on acceptability or otherwise on various data as well as the procedure to be followed based on the hydrologist's knowledge and experience. According to him, when

595

a water availability assessment is to be done for planning of utilization of water of a basin, practical considerations rule out taking a position that adequate and/or reliable data is not available and therefore water availability assessment will have to wait till adequate and reliable data becomes available.

The

witness has emphasized that the quantity and quality of data available is an important factor in determining what is the most reasonable method, whereas the scrutiny of the available data, rejection of suspect data, modification of data using statistical methods, are all part of the method of assessment. The witness has continued to state that most reasonable assessment of water availability is not static, and as mankind's understanding of the science improves and also as more data becomes available, the most reasonable assessment of water availability may undergo a revision and such periodic revisions are routine in the field of hydrology. The witness informed the Tribunal that the guidelines regarding minimum density of observation stations for various parameters for different geographical units are given in the

World Meteorological Organization (WMO) publication No. 168 “Guide to Hydrological Practices”, and as per these guidelines, for mountain region, the number of stations required in 2032 sq.km.

Mahadayi basin have been assessed and presented in a Table which is reproduced as under.

Parameter	**Area in SqKm per station**	**Minimum Number of stations**	**Actual number of stations in Mahadayi basin**
Precipitation	250	8	6(IMD stations) *Kanukmbi, Amagaon, Jamgaon, Valpoi, Mapusa, and Panjim*
Stream flow	1,000	2	1* (CWC stations)
Sedimentation	6,700	1	NIL

[* Number of CWC operated stream-flow stations is 2, at Ganjem and at Collem. But the Station at Collem measures a small catchment area and this area is hydrologically similar and adjacent to the area measured by the station at Ganjim. Therefore for all practical purposes there is only one stream – flow measurement station operated by the CWC, at Ganjem.]

61.

The witness has stressed that there is not a single

CWC gauging station on many significant tributaries of Mahadayi viz. Ragada, Kotni nadi, Bail nadi, and Surla nadi on which projects have been proposed by the States of Karnataka and Maharashtra.

According to the witness, they are unguaged.

According to the witness, hydro-meteorological data is a transient, i.e. if not correctly measured at the very moment a

hydro-meteorological event takes place, the data is lost forever and there is no way to resurrect that data. It is emphasized by the witness that the implication of this is that a post facto second measurement for verification of hydro-meteorological data is not possible and an assessment of the reliability of any hydro-meteorological data can be made only indirectly.

After

mentioning that he has personally visited various locations in the Mahadayi basin t o obtain a “clinical picture” of the basin, the witness has mentioned that he had found wildlife sanctuaries; two famous waterfalls of Dudhsagar and Surla; some of the locations where projects are contemplated by the States of Karnataka, namely Kalasa Dam, Bhandura Dam, Haltara Dam, Surla Diversion site and those proposed by the State of Maharashtra namely Virdi Dam site. The witness has claimed that at Ganjim till the year 2000, the discharge observations were done by a method known as “float method” whic h is the least accurate and therefore accuracy of discharge data prior to the year 2000 is questionable. The witness has further deposed that

at Ganjim site, a weir has been constructed downstream of and very close, to the observation site in the year 2006, which has changed the gauge-discharge relationship at Ganjim. The witness proceeds to state that he found that CWC had not made

necessary changes in its discharge measurement and had not taken into consideration the cognizance of the construction of the said weir. Therefore, the witness asserts that the data at Ganjim after the year 2006 is questionable. The Witness has further mentioned that the fact that CWC failed to take cognizance of the construction of a weir at Ganjim, raises a strong doubt on the competence of the observation staff and the quality of supervision. According to the witness, the CWC staff is not adequately trained and adequately supervised for taking correct observations in a correct manner and therefore, there is every possibility that before 2006 also, the incompetence and/or lack of supervision persisted, as a result of which the data prior to the year 2006 is also suspect. The witness has mentioned that his observations on the quality of discharge data are corroborated by the fact that in all the yield studies conducted by different agencies, the runoff factor, i.e. the percentage of rainfall volume flowing through the river as runoff is coming to be very high i.e. in some cases it is even more than 100%, but in most years it is as high as 80%. The witness has explained that

the runoff coefficient is primarily determined by the losses from the rainfall and according to him higher the losses, the lower the rainfall and runoff coefficient. The witness has mentioned that

the most important losses are evaporation, evapo-transpiration, and percolation and considering that the upper catchment of Mahadayi River particularly in Karnataka, is densely forested area, the direct evaporation from the rainfall intercepted by the forest canopy would be very high, whereas consumptive use of water by the forest would also be very high and the presence of a forest indicates porous soil and therefore, the percolation will also be very high. The witness has mentioned that rainfall/runoff coefficient as high as 80% is indefensible for this catchment. The witness has stated that error either in the rainfall data or the discharge data, can result in very high runoff factors, but, the number of rainfall stations is many and therefore, it is possible to check the data of one station against that of another.

The

witness has pointed out that it is highly unlikely that all the stations made an observational error of similar type in the same years. The witness has explained that measurement of rainfall is relatively a simple procedure, while the measurement of discharge is much more complicated and therefore requires a

high degree of competence and diligence.

The witness has

proceeded to mention that the preferred method to compute

75% dependable, or 50% dependable, or any other percentage

of dependable runoff, in a basin, is by analysis of time series

runoff data of that basin, and for such analysis, the science of hydrology neither specifies any rule as to what should be minimum length of the time series, nor specifies any rule as to what length of time series is adequate, and therefore a Hydrologist has to do with whatever data that is available. The witness claims that longer the length of time series data available, higher is the probability of results being closer to their true value, provided that the quality of data is good. The witness points out that shorter the length of time series data, there is lower probability of results being closer to their true value. The witness has mentioned that river valley projects inflict a huge cost on the people and there is financial cost in terms of money and also there are environmental costs like diversion of forest land for non-forest purposes and changes in the flow pattern in the river which further impacts the ecology. Further there are social costs in terms of people displaced from their homes and farms and loss of livelihoods. The witness therefore claims that when there is a doubt about the accuracy of water availability assessment, it is preferable to err on the safer side i.e. on the

lower side. The witness further mentions that 75% dependable or 50% dependable or any other percentage dependable water availability assessment refers to only natural flow as what would

have been, had there been no human intervention and it only refers to the total water that is available for specified dependability and it does not necessarily mean that this quantity of water is available for human consumption because the nature also needs water for ecological functions.

The witness has referred to Clause 1.3(v) of National Water Policy of 2012 to emphasize that water is essential for sustenance of eco-system and therefore, minimum ecological needs should be given due consideration. The witness has further referred to Clause 3.3. of the said policy to emphasize that a portion of river flows, should be kept aside to meet ecological needs to ensure that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use. The witness has asserted that as to whether Mahadayi basin is a surplus basin or a deficit basin can be determined only after the environmental needs are assessed through a scientific study, as stipulated in the National Water Policy, in the table given in paragraph 35 of his Affidavit.

According to this witness Tennant DL (1976) has associated a likely quality of water of habitat with various ranges of environmental flow expressed as percentage of Mean Annual

602

Flows. This is shown by the witness in the Table given in paragraph 35(a) of his Affidavit, which is as under:

Quality of Habitat	Environmental flow as % of Mean Annual Flow	
	October to March	April to September
Outstanding	40%	60%
Excellent	30%	50%
Good	20%	40%
Fair or degrading	10%	30%
Poor or minimum	10%	10%
Severe degradation	<10%	

62.

The witness has claimed that for maintaining even a good quality of habitat, the environmental flow will have to be

60% of the Mean Annual Flow (MAF), 20% during October to March i.e. dry season and 40% during April to September i.e. rains season. The witness stated that as to whether the water allocation should be based on 75% dependable flow or 50% dependable flow would depend upon if the distribution of runoff is exactly as per normal distribution then the 50% dependable flow would be the same as mean annual flow. However, the witness has hastened to add that the practice in India is that the projects are designed to use the 75% dependable flow, whereas

in some cases viz., in chronic drought prone areas, sometimes the projects may be designed to utilize the 50% dependable flow but the Western Ghats do not fall in that category and therefore the water availability should be assessed on a 75% dependable basis for Mahadayi basin and at the places where the State of Karnataka and the State of Maharashtra have proposed other disputed projects. The witness has described Mahadayi river in great detail in paras 39 to 43 and has stated in paragraph 44 that "the Mandovi river basin can geologically be broadly divided into four distinct sub-regions, west to east namely: (i) The coastal plains with dominant marine lands on the west; (ii) The vast etch plain adjoining the coastal plains; (iii) Low dissected denudational hills and table land; (iv) Deeply dissected high Western-Ghat denudational hills".

63.

The witness has stated that Mahadayi river valley comprises the Western Ghat Zone in Karnataka, Maharashtra and Goa on the western slopes of the Sahyadris and the valley includes Mahadayi wildlife sanctuary, Bhagwan Mahavir Wildlife

Sanctuary and Mollem National Park, Dr. Salim Ali Bird Sanctuary, Bondla Wildlife Sanctuary and Bhimgad Wildlife Sanctuary. The witness has informed that Mahadayi River Basin in Goa

comprises an area of 1580 sq.km. which is about 43% of Goa's total geographical area. The witness has claimed that Mandovi planes downstream comprise an intricate system of wetlands; tidal marshy areas cultivated paddy fields known as khazans; all intercepted by canals, base lagoons, creeks and is influenced by tidal actions upto Ganjim. According to the Witness, the Ministry of Environmental and Forest had appointed initially the Western Ghats Ecology Expert Panel and there is specific recommendation by the said Committee that no new dams or large scale storage be permitted in ecological sensitive zone, as also no interlinking of rivers be permitted anywhere in Western Ghats. The witness has claimed that although the report has very many features and diverse topics and has not been fully accepted by the Ministry of Environment & Forest, nonetheless the fact remains that ecology experts have categorically recommended that neither any dams nor any diversion of river be permitted in the Western Ghats.

64.

In paragraph 51 of his Affidavit, the witness has broadly sub-divided Mandovi River into three zones of sub-

regions based upon geographical utility features which are (i) The sub-region of about 530 sq.km. are in the upper most region of the river basin located in Goa and known as conservation zone;

605

(ii) The downstream of the conservation zone which is the drainage area of the Mandovi river basin admeasuring about 541 sq.km. at low altitudes above the sea level where most of the population is concentrated and is known as population/industrial zone; (iii) A stretch/sub-region of 509 sq.km. of basin area in its final reach is in salinity and very fragile river zone. This is the area/sub-region, where river meets the Arabian Sea. In the main river, this saline reach extends up to Ganjim where further ingress of salinity is arrested by a weir.

65.

According to the witness, it is pertinent to note that the fresh water flow from any river restrains the extent to which salinity intrudes into that river and with global warming, the sea levels are bound to rise which would subsequently increase the proportion of saline water in the river.

The witness has mentioned that the aquatic life is sensitive to the concentration of salts and increase in the salinity levels can be destructive to the aquatic ecology of the river. Thus, it is maintained by the

witness that an increased fresh water flow would be required to restrict the salinity/concentration of salts. Diversion of water outside the basin by the State of Karnataka and/or by the State of Maharashtra would reduce the ground water recharge and

enable increased intrusion of salt water in the aquifer. Again in paragraph 57 of his Affidavit, the witness has emphasized, while addressing the matter on point of availability of water in Mahadayi basin, two important aspects should be considered, namely (a) the minimum environmental which is required for the purpose of sustaining the precious wildlife, biodiversity, forest and thick vegetation and (b) the implications and effect of any abstraction or diversion at the upstream level on the flow of the water level from such point. The witness has expressed opinion that abstraction of water on the upstream will have an impact of reducing the flow in the downstream which is particularly of concern in case of Mahadayi river, where there are two major waterfalls namely; Dudhsagar and Ladkycho Vozar, also known as Surla waterfalls, downstream of the disputed projects planned by Karnataka and in case of any abstraction the waterfalls will be severely affected. The witness has asserted that the proposed projects of the State of Karnataka, as also that of State of Maharashtra cannot be permitted to be undertaken. The witness stated that on the basis of assessment of water availability in the

river and without taking into account, the environmental impact and implications of the projects, on the flow of the river itself and

their ecological consequences, particularly having regard to the ecological sensitive characteristics of the region.

66.

Shri Chetan Pandit, AW1, the Expert witness on behalf of the State of Goa has also filed an Affidavit in evidence dated 4.8.2016 (Volume 191).

67.

After emphasizing that through the aforesaid Affidavit he is deposing limited to the part of Hydrology evidence, he has stated in para 2 of his said Affidavit that he had conducted a study on water availability in Mahadayi basin and had prepared a Report dated 3.8.2016, which has been annexed by him as Annexure-A to his Affidavit. In paragraphs 3 to 13 of his this Affidavit, he has again given his bio-data and spoken about his expertise in the field of hydrology. In paragraph 14 of his Affidavit-in- Evidence, he has stated that based on his qualification, knowledge and experience in practice of water resources management and engineering hydrology he has conducted a study of the water availability in the Mahadayi basin.

According to him, he has particularly examined the following aspects:

608

a. The rainfall data available, from IMD and also other sources.

b. The river discharge data available from the CWC.

c. The map of the basin, with location of the rainfall stations, discharge observation stations, and catchment boundaries, marked on it.

68.

The witness has claimed that he had seen the earlier Report prepared by NWDA, CWC and IISc but without going through the details of their computations. He has mentioned that he had visited the various locations in the catchment trying to understand the topography and land use. He has further claimed that he had visited the gauge and discharge sites at Ganjim and Collem, to get a firsthand feel of the ground realities at those sites. He has stated that in his this Affidavit that he was aware of the facts that environment in the Western Ghats is a key issue and water environment are inextricably linked, and therefore he had read the report prepared by the Western Ghats Ecology Expert Panel to get a grasp of the environmental

concerns in the Mahadayi basin.

609

69.

Based on his inputs, he claims that he had analyzed the yield of Mahadayi basin and his conclusions are presented in the Table which is part of paragraph 19 of his this Affidavit. The said Table is reproduced hereunder.

Yield		MCM	TMC
Runoff over entire catchment. Area 2032 Sq. Km	50% Dependable	5039.8	178.0
	75% Dependable	4372.4	154.4
Usable Yield Catchment Area 1523 sq.km	50% Dependable	3777.3	133.4
	75% Dependable	3277.2	115.7

70.

According to him, the rainfall is neither uniformly distributed in space, nor is consistent in time. He claims that within a catchment, the rainfall in some areas may be relatively

more as compared to some other areas in the same catchment, whereas in some years the rainfall is more than average, while in some years, it is less than average and consequently the flow in the river also varies from year to year. After pointing out certain practical difficulties in the measurement of rainfall and river flow, the witness has stated in paragraph 2 of his this Affidavit that the catchment areas are invariably very large extending over

thousands of square kilometers, but the rain gauge measures rainfall at only a point and there is no escape from having to accept the measurement at a point as representative of the measurement over a large area. It is pointed out by him that the river flow measurement is an instantaneous measurement, i.e. at an instant of time, but is required to be taken as representative of the flow over a duration of time, typically 24 hours. According to him, when a water availability assessment is to be done for planning of utilization of water of a Basin,

practical

considerations rule out taking a position that adequate and/or reliable data is not available and therefore the water availability assessment will have to wait till adequate and reliable data becomes available. It is emphasized that the water available assessment of any basin including that of Mahadayi basin, will have to be done with whatever data that is available at the time of making assessment. The witness has explained in paragraph 26 of his this Affidavit that the most reasonable assessment of water availability is not static, and as mankind’s understanding of the

science improves, and also as more data becomes available, the most reasonable assessment of water availability would undergo a revision. It is claimed by the witness that such periodical revisions are routine in the field of Hydrology. In para 27 of his

611

Affidavit, he has mentioned that he has taken into consideration the guidelines given in the World Meteorological Organization (WMO) publication No. 168 “Guide to Hydrological Practices”, and has assessed the number of stations required for catchment area of 2032 sq.km. of Mahadayi basin as per these guidelines and the same is presented in a Table, contents of which are same as mentioned in the Table in para 19 of his Affidavit dated 15.9.2015 (Volume 165). The Table is already reproduced in para 60 of this Report.

71.

What is important is that this witness has stated in paragraph 28 that there is no single CWC gauging station on many significant tributaries of Mahadayi, viz. Ragada, Kotni nadi, Bail nadi and Surla nadi on which projects have been proposed by the State of Karnataka and Maharashtra and that those rivers on which State of Karnataka has proposed projects are ungauged. In para 31 of his Affidavit, he has informed that at Ganjim, till the year 2000, the discharge observations were done by a method known as “float method”, which is the least accurate and

therefore accuracy of discharge data prior to the year 2000 is questionable. He has further stated that at Ganjim site, the weir has been constructed downstream of and very close to the

observation site, some time in the year 2006, and this weir would change the gauge-discharge relationship at Ganjim, but, he had noticed that CWC had not made necessary changes in their observation of discharge measurement, nor taken cognizance of the construction of the said weir, and therefore the data at Ganjim after the year 2006 is questionable. He has pointed out that the fact that CWC failed to take cognizance of the construction of a weir at Ganjim, raises a strong doubt on the competence of the observation staff and the quality of supervision. The witness proceeds to state that if the CWC staff was not adequately trained and had not adequately supervised while taking correct observations in a correct manner, the data prior to the year 2006 becomes suspect. What is claimed by him is that in all the yield studies conducted by different agencies, the runoff factor, i.e., the percentage of rainfall volume flowing through the river as runoff, is coming to be very high and in some cases it is even more than 100%, but in most years, it is as high as 80%. After pointing out that the runoff coefficient is primarily determined by the losses from the rainfall, it is stated by him that

higher the losses, lower the rainfall runoff coefficient.

The

witness has asserted that the most important losses are

evaporation, evapotranspiration, and percolation and considering

that the upper catchment of Mahadayi River particularly in Karnataka is densely forested area, the direct evaporation from the rainfall intercepted by the forest canopy would be very high. The witness proceeds to state that the consumptive use of water by the forest would also be very high and the presence of a forest indicates porous soil and therefore, the percolation will also be very high. Based on his experience as a Hydrologist, the witness has stated that rainfall/runoff coefficient as high as 80% is indefensible for this catchment. After mentioning that the preferred method to compute 75% dependable, or 50% dependable, or any other percentage of dependable runoff in a basin is by analysis of time series runoff data of that basin, the witness has stated that the longer the length of time series data available, higher the probability of results being closer to their true value, provided, of course, that the quality of the data is good. The witness asserts conversely, that the shorter the length of time series data lowers the probability of results being closer to their true value. The witness has informed in para 40 of his Affidavit that the 75% dependable or 50% dependable or any

other % dependable water availability assessment refers to only the natural flow as would have been, had there been no human intervention and it refers to the total water that is available for

specified dependability. The witness has made a reference to the National Water Policy of 2012 and informed that as per clause 1.3(v), water is essential for sustenance of eco-system and therefore minimum ecological needs should be given due consideration. The witness has made a reference to clause 3.3 of the said policy and has stated that a portion of river flows should be kept aside to meet ecological needs, ensuring that the low and high flow are proportional to the natural flow regime.

72.

After emphasizing that the water availability should be assessed on 75% dependable basis for Mahadayi basin and at places where the State of Karnataka and the State of Maharashtra have proposed for disputed projects, it is stressed that the Mandovi River can geologically, be broadly divided into four distinct sub-regions west to east, namely. (i) The coastal plains with dominant marine lands on the west; (ii) The vast etch plain adjoining the coastal plains; (iii) Low dissected denudational hills and table land; (iv) Deeply dissected high Western Ghat denudational hills.

73.

After mentioning that the river drains in total area of

it is

approximately 2032 sq.km., spread over the three States,

stated by the witness that Mandovi river in the State of Goa, can be broadly sub-divided into three zones or sub-regions based upon geographical utility features. (i) The sub-region of about 530 sq.km. are in the upper most region of river basis located in Goa i.e., Conservation Zone; (ii) The downstream of the conservation zone is the drainage area of the Mandovi river basin measuring about 541 sq.km. at low altitudes above the sea level, where most of the population is concentrated and this zone is known as population/industrial zone; (iii) A stretch/sub-region of 509 sq.km. of basin area in its final reach is in salinity and very fragile river zone. This is the area/sub-region, where river meets the Arabian Sea. In the main river, this saline reach extends up to Ganjim where further ingress of salinity is arrested by the weir.

74.

What is reiterated by the witness is that any abstraction of water on the stream will have an impact of reducing the flow in the downstream and this is particularly, of concern in case of Mahadayi river where there are two major waterfalls namely Dudhsagar and Ladke-cho-Vazor also known as

Surla waterfalls which are downstream of the disputed projects. The witness has stated that any abstraction of water would adversely affect global bio-diversity hotspots, five sanctuaries,

several rare species, and other richness of flora and fauna situated in the State of Goa. In para 71 of his Affidavit, the witness has mentioned that State of Goa has existing and proposed drinking water projects and irrigation projects and therefore any diversion or abstraction of water from the main Mahadayi river and/or its tributaries in the upstream by the States of Karnataka and/or Maharashtra would further reduce the flow in the rivers jeopardizing even the drinking water projects.

75.

As noticed earlier, the witness has annexed his report dated 03.08.2016, as Annexure A, along with his Affidavit dated 04.08.2016. In the Report, the witness has mentioned in detail Mandovi river basin and after explaining as to what is meant by the yield of the basin, the witness has referred to Hydrology in paragraph 3 of his report. The witness has referred to 2001 CWC Report and has mentioned that two different estimates of 75% and 50% dependable runoff are given in the same Report, as if the hydrologist who conducted the yield study was not sure of

what path to follow and therefore offered two different estimates. The witness has given the review of yield study done in the past in para 5 of his report, whereas in para 6 of the Report

general methodology to be adopted while making assessment of water availability has been given. After emphasizing that Thiessen Polygon and linear regression are used for want of any better method, the witness has enumerated the steps to be undertaken for filling of missing data. The witness has detailed the data availability in Mahadayi basin in paragraph 7 of his Report, whereas information relating to rainfall data is mentioned in paragraph 8 in the report and information relating to discharge data is mentioned in paragraph 9 of his Report. According to the witness, CWC measures gauge and discharge at two stations i.e., at Ganjim and that at Collem. Ganjim is on the main river Mandovi and intercepts a catchment of 880 sq.km., whereas Collem is on a tributary called Khandepar and intercepts only 117 sq.km. of catchment. Regarding river flow data, the witness has mentioned that the station at Collem measures a small catchment area and this area is hydrologically similar and adjacent to the area measured by the station at Ganjim, and therefore, the Collem data does not necessarily add to the information because data is what is observed in the field,

whereas the information is defined as the “meaning attached to data”. The witness has mentioned that for visiting the gauging site at Collem, one has to park the vehicle at a certain location

and then walk along a railway line for about half a kilometer, where there is a railway line on the right hand side, and a steep vertical mountain side on the left hand side, with barely a couple of meters of space between the two. What is mentioned by the witness is that when he had visited the Collem site, no place could be seen by him where CWC personnel making the discharge observation could take shelter during heavy rainfall, or rest between the observations.

The witness has further

mentioned that CWC has not made necessary changes in its observation resulting to discharge assessments taking notice of the construction of the weir downstream. In paragraph 12 of his Report, the witness has mentioned about the selection of rainfall stations, whereas in paragraph 13 of his Report the witness has mentioned about consistency checks on data. In paragraph 14 of his report, the witness has stated as to how the missing data has been filled. After defining catchment which should be taken into consideration while estimating yield, the witness has mentioned in paragraph 15 of his Report that 509 sq.km. should be excluded

while making assessment of the yield. The witness has referred to correction for discharge observed by float method and has ultimately computed the yield of Mahadayi basin in paragraph 19

of his Report the content of which are same as that of the Table reproduced in para 69 of this Report.

76.

This witness AW-1, has filed his third Additional Affidavit of Examination-in-Chief on 12.09.2016 (Volume 192). The witness has mentioned that he has already filed his Affidavit of Evidence dated 4.08.2016 on the issues pertaining to the aspects of hydrology and water availability and a report on the Yield Study on Mahadayi basin. The witness has mentioned that his this additional Affidavit dated 12.09.2016 is a continuation of his earlier Affidavit-in-Evidence dated 04.08.2016, and that he is deposing as a witness of the State of Goa on some of the issues other than hydrology and water availability, upon which he is supposed to depose.

77.

In paragraph 76 of his additional Affidavit, the witness has mentioned the case of State of Goa. According to this witness, India first formulated a National Water Policy in 1987, which was revised

in 2002, and then again revised in 2012.

According to the witness, though revision has been made in National Water Policy of 1987, certain principles have remained unchanged and two important principles are that (a) Basin as a

unit for all water planning (b) drinking water to have highest priority for allocation of water. In paragraph 79 of his additional Affidavit, the witness has reproduced Clause 3.2 of National Water Policy 1987, whereas in paragraph 80, the witness has reproduced Clause 1.3(vii) from National Water Policy of 2012. The witness has also reproduced Clause 2.3 of National Water Policy of 2012 in paragraph 82 of his additional Affidavit and maintains that the principle is that basin as a unit for hydrologic planning should be adopted. The witness has asserted that by formulating plans for water management in Malaprabha basin, based on diversion of water from the Mahadayi basin, this basic principle laid down in National Water Policy has been violated. The witness mentions that in the National Water Policy of 1987, the water allocation priorities have been defined in Clause 8 and drinking water is stated as priority 1, followed by irrigation and then for other uses. The witness mentions that the sequence of priorities in National Water Policy of 1987 was repeated in Clause 5 of the National Water Policy of 2002. The witness has stated that by the year 2002, importance of environmental flows was

starting to get appreciated, and the National Water Policy of 2002 included ecology at 4 th priority for uses of water.

In paragraph 89 of his additional Affidavit, the witness has

emphasized that in the National Water Policy of 2012 Clause 1.3(vi) was introduced and inter-alia states that safe water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs including needs of animals, achieving food security, supporting sustenance agriculture and minimum eco-system needs. According to the said policy, available water after meeting the above needs should be allocated in a manner to promote its conservation and efficient use. After mentioning that National Water Policy finalized in a meeting of National Water Resources Council, the witness has stated that various States, including the State of Karnataka who were present in the said meeting had not raised any objections on the two principles, namely basin as a unit for all planning; and drinking water to have first priority. What is mentioned by the witness is that if indeed there is a shortage of water for domestic use in Malaprabha basin, and then it is entirely because of disregard to the principle of highest priority to the drinking water and allocating water to other uses, including a Pepsico bottling plant,

and sugarcane farming.

622

78.

After referring to the Clause 1.3(vi) of the National Water Policy of 2012, the witness has mentioned that all the provisions of the National Water Policy have been openly flouted in the Malaprabha basin, by supplying water for sugarcane cultivation. The witness has stressed that water is being supplied to a water guzzling cash crop like sugarcane, over-riding the higher priorities of drinking water, ecology, food security and sustenance. The witness has in detail referred to the cropping pattern, as stated in the modified DPR of the Malaprabha project (Vol ume 33B) and referred to table titled “Salient Features” wherein cropping pattern is mentioned. The witness mentions that neither the cropping pattern, as per the approved project nor the cropping pattern as per the revised project, includes sugarcane. Therefore, cultivation of sugarcane is in violation of the cropping pattern, as stated in the DPR, which is an act of water mismanagement. In para 96 of the additional Affidavit, the witness has stated that the Pepsico unit in Dharwad district is a unit of a MNC soft drink company which is being supplied 4 lakh

liters of water every day by the Karnataka Water Board and the witness mentions that it is learnt from information available on the internet, that the Agreement between the Karnataka Water Board and the Pepsico is for supply of only 2 lakh liters per day,

but the unit was being supplied 4 lakh liters of water every day. What is stated by the witness is that the above stated 4 lakh liters per day would satisfy the household domestic requirement of 16,000 people at 25 Liters Per Capita per Day (LPCD), year round. The witness has claimed that in many places in India, the soft drink plants are being shut down to restore water supply to rural areas, and the most well-known example is that of Plachimada in Kerala where a soft drink bottling plant of a Multinational Company was shut down after protest by the local people, despite being on the western side of Western Ghats, and in a higher rainfall area compared to Dharwad, which is on the eastern slope of Ghats. The witness has further mentioned about the industrial profile of Dharwad district, which is available at the website of the Union Ministry of Micro, Small and Medium Enterprises (MSMEs) and has stated that the number of total industrial units in Dharwad district is 18,877, of which only 924 are registered, which indicates an unplanned growth of the industry. The witness has referred to paragraph 5 of Annexure 11 to Document No. 183, wherein it is inter-alia stated that one

of the issues is lack of basic amenities like drinking water. The witness claims that thus it is seen that far less water for the industrial process, there is no water even for drinking and yet

more industries are being promoted by the State of Karnataka. The witness asserts that newer industries continue to get promoted and on the website it is indicated that 57 new industry units were approved in 2016 in Dharwad district at an investment cost of Rs.282.51 crores. The witness asserts that water shortage in Malaprabha basin, if at all, is entirely man-made due to misplaced priorities for allocation of water and this alleged shortage cannot be made good by importing
water from
Mahadayi basin. The witness has mentioned in paragraph 101 of his additional Affidavit that the Malaprabha Reservoir Project in Naviluteertha in Belagavi District, in Karnataka was completed in the year 1974. The witness has stated that a DPR for this Project was approved by the Planning Commission in the year 1963, which was then revised in the year 2009, which is produced by the State of Karnataka at Volume 33B. The witness asserts that a comparison of the project features of these two project formulations reveals that as per the original approved DPR, the annual water availability at 75% dependability was assessed at

about 47 tmc but in the revised DPR, the yield was reduced to about 27 tmc. What is mentioned by the witness is that in the years immediately following the completion of reservoir, the State of Karnataka should have observed that the reservoir was

not filling as often, as it should, and that the annual yield is less than the estimated yield and that the reduction in yield was because of an incorrect hydrologic study earlier, or because of direct pumping from the reservoir area by the lift irrigation schemes or some other reason. It is emphasized by the witness that the State of Karnataka should have controlled the further use of water to match the annual observed yield, by controlling the cropping pattern and promoting water saving techniques such as drip and sprinkler irrigation and conjunctive use of surface and ground water etc., but on the contrary, the State of Karnataka is supporting irrigation of sugarcane, which is a water guzzler crop to replace the crops which require less water. The witness has referred to replies provided by the State of Karnataka to the interrogatories raised by the State of Goa, and it is claimed that in Malaprabha command the area under sugar cane cultivation has increased from 224 Ha in the year 1979-80 to 2756 Ha in the year 2012-13. What is emphasized is that in the modified DPR only 0.216 tmc of water supply is earmarked for drinking and industrial requirement and water for not only sugar

cane but any irrigation should have been supplied only after supplying the water for drinking.

626

79.

The witness states that from the index map of the Malaprabha Project, it is evident that there are at least two major tributaries on the right bank of Malaprabha River – Joul Nalla that borders the command area and joins near the village Konnur and the Bannehalla Nalla which cuts across the command area and joins Malaprabha River near the village of Menasagi. The witness has pointed out that Joul Nalla has a catchment area of 244 sq.km., whereas the Bennehalla Nalla has a catchment area of around 5048 sq.km., which is more than twice the entire Mahadayi basin catchment area. According to the witness, a proposal to utilize the waters of Bennehalla Nalla was prepared by Mr Sudheer Sajjan, who is/was an engineer with the Water Resources Department of Govt. of Karnataka, and in this proposal, Mr Sajjan had estimated the yield of the Benehalla Nalla as 10.92 tmc at 75% dependability, of which as per the same proposal hardly 1.5 tmc was put to use. In paragraph 107 to 112 of his additional Affidavit, this witness has mentioned about his familiarity with the implementation of inter-State water

agreements and awards and maintains that a downstream State is placed in a geographically disadvantageous position and is at the mercy of the upstream State for release of water.

The witness has explained that Mahadayi basin is a special case of its

encompassing four wild life sanctuaries and one bird sanctuary and generally being in the eco-sensitive zone of very rich bio-diversity. What is mentioned by the witness is that not only the main river Mahadayi, but some of its tributaries also, originate in the States of Karnataka or Maharashtra and flow down to the State of Goa, as a result of which projects for consumption of water for irrigation, drinking water and industrial use are located on these branches/tributaries. The witness maintains that in case this Tribunal permits any project on this inter-State river, then it is essential that the Award may give detailed instructions regarding quantity of water to be used by upstream State not only in each project but also at various period of time.

In

paragraph 115 of his additional Affidavit, the witness has spelt out the water sharing formulae for three scenarios namely, (a) Normal year (b) Wet Year and (c) Dry Year. The witness has further stated that whether any year as a whole is normal/wet/dry will be known only at the end of the monsoon season, but the water withdrawal and release decisions have to

be taken throughout the year at regular intervals and therefore appropriate directions should be given by the Tribunal while passing the Award.

628

80.

In paragraphs 121-135 of this additional Affidavit, the witness has emphasized the necessity of setting up of machinery for implementation of inter-State agreement or the Tribunal Award.

81.

Pursuant to the liberty granted by the Tribunal vide its Order dated 29.11.2016, the Expert Witness AW1 (Shri Chetan Pandit) has filed an additional Affidavit on 04.01.2017 under head “ADDITIONAL AFFIDAVIT -IN-EVIDENCE OF SHRI CHETAN PANDIT, DEPOSING AS AN EXPERT WITNESS ON BEHALF OF THE STATE OF GOA” (Volume 196). The witness has mentioned in paragraph 2 of this additional Affidavit that he is deposing before the Tribunal limited to the part of hydrology evidence, more particularly the aspect of water availability in Mahadayi basin at certain specific locations. In para 3 of his additional Affidavit, the witness has stated that he has already filed an Affidavit-in-Evidence dated 4.8.2016 which is placed on record and that he is filing the present additional Affidavit in continuation of his earlier

Affidavit dated 4.8.2016. The witness has repeated and reiterated the contents of said Affidavit dated 4.8.2016.

629

82.

In para 4 of the additional Affidavit, the witness has stated that he had conducted a further study and as per Report dated 04.01.2017, which is annexed to the additional Affidavit as Annexure-A. The witness has stated that by filing the additional Affidavit he is proving the contents of the said Report dated 04.01.2017. According to the witness, the rainfall and discharge data and various maps and other reports were made available to him by the Water Resources Department, Govt. of Goa. In paragraph 8 the witness has stated that based on his study, the yield at particular project locations is mentioned in Table-1 and the same is reproduced hereunder.

Table 1: Summary of Results

	Catchment Area Sq.Km.	50% Dep Yield TMC	75% Dep Yield TMC
Kotni Dam (independent catchment)	93.19	8.9450	6.5881
Bhandura Dam	32.25	2.2140	1.4961

Bailnadi	32.25	2.5365	1.7667
Kalsa (including Haltara and Surla diversions)	25.5	2.9655	1.9767
Irti Diversion	8.78	0.7685	0.3968
Irti pickup dam	9.91	1.0084	0.8089
Diversion to			

Kali Basin			
(a)Katla-Palna Diversion	22.5	1.7337	1.5174
(b)Diggi Diversion	15.6	1.2021	1.0521
(c)Viranjole Diversion	9.5	0.8756	0.7320

83.

According to the witness, the availability as given in Table 1 above is only the availability, and not necessarily the water available for use in the upstream area and that the quantity required for maintenance of eco-system in the highly eco-sensitive Western Ghats and also the quantity required for downstream users will have to be taken out and only the balance quantity, if any, will be the quantity available for use in the upstream area. The witness claims that as far as he is aware, the quantity of water thus required for maintenance of the eco-system, and also quantity of water required for meeting the

needs of downstream users, has not yet been determined.

84.

In the Report dated 04.01.2017, it is mentioned by the witness that when a project is planned on a river for use of water for domestic supply, irrigation, hydro power generation, industrial supply or any other objective, it becomes necessary to

estimate the yield at the proposed project location. What is maintained by the witness is that in Mahadayi basin, the State of Karnataka has planned several projects and as of 04.01.2017, far less there be an approval for any of the projects, neither the location of any of the projects is final, nor there is any approval for the quantity of water to be used for any particular purpose.

85.

In para 2 of his report, the witness states that if the river flow data, also called discharge data, for a sufficiently long period are available at the proposed project location, then the yield can be estimated directly using the discharge data but if such discharge data at the project location are not available then the yield must be estimated indirectly using the discharge data available at some other location. The witness has pointed out that a commonly used method is to estimate the yield at some place where discharge data are available from which computation of the yield per unit catchment area (per sq.km.) can be arrived at and the same can be applied to the catchment

area at the proposed projection location. The witness states that a correction is sometimes applied to account for difference in the mean rainfall in the gauged catchment and ungauged catchment. What is emphasized by the witness is that in case of Mahadayi

basin, the yield has been estimated by using the data at Ganjim and therefore the yield per unit area can be computed for the catchment area at Ganjim, and then applied to the catchment area of different projects; what is claimed is that since the catchment area at Ganjim is larger than the catchment areas at project locations, this is an exercise of estimating “part” from the “whole”. According to the witness, this method may be used if the “whole” and “part” are similar viz., the rainfall for the “whole” and for the “part” should be uniform; the rainfall in the “part” should occur roughly at the same time as in the “whole”. The physiography of the “whole” and the “part” should be similar; the land use in the “whole” and “part” should also be similar; and there should not be too much reduction in the catchment area.

86.

According to the witness, in case of the River Mahadayi, none of the above stated conditions are sufficiently satisfied. The witness states that the catchment area at Ganjim is 880 sq.km., while the catchment areas at the project sites are

much smaller, varying from 93.19 sq.km. for proposed Kotni dam to only 8.787 sq.km. for the proposed Irti diversion dam. The witness mentions that there is a wide variation in the rainfall in

different places in the catchment and the annual mean rainfall varies from 3042.6 mm at Jamagaon to 4870.8 mm at Krishnapura; what is reported by the witness is that to examine the time of occurrence of rainfall, a study was done to compare the monthly rainfall expressed as ratio to its own mean (as percentage) at station pairs and the outcome of one such study is shown in Table 3 of the report as an example, where July rainfall at Amagaon and Valpoi have been compared, the witness states that it is seen that in 1966, 1968, 1969, 1970, 1974, 1975 and 1982, rainfall in Amagaon is below mean, while in Valpoi it is above mean. According to the witness in 1990, 1992, 1996, 1997, 2000 and 2001 it is the other way round. In para 5 of the Report, the witness has pointed out that physiography and topography of the two areas are much different because the upper catchment is a plateau at a higher elevation and has a different type of forest and different climate than the middle and lower parts of the catchment. As reported by the witness a correction can be applied for the difference in mean rainfall, by multiplying the yield by ratio of mean rainfall in “part” and in “whole”, but, it is

not possible to apply a correction for these other differences. It is claimed that the mean rainfall in upper catchment is more than the lower catchment. As a result, the yield per unit rainfall in

upper catchment can be less than that in the lower catchment, because discharge equals rainfall minus the losses, and in upper catchment the losses can be more. It is further stated by the witness that in upper reaches the rivers tend to be influent i.e. contribute to ground water while in lower reaches the river tends to be effluent, i.e. ground water (which has percolated in the aquifer in upper reaches) contributes to river flow. The witness claims that this is explained in an extract from the website of "Indian Agricultural Statistics Research Institute" enclosed at Appendix 1 of the Report at Annexure A. What is claimed is that in case of Mahadayi basin, the upper catchment in Karnataka is a plateau, which would increase retention time of the rainfall and thereby result in more percolation. The witness mentions that it is a known fact that the sum of 75% dependable yield for sub-catchments does not equal the 75% dependable value for the whole catchment and conversely 75% or 50% dependable yield for the whole, if distributed over the parts, will not equal the 75% or 50% dependable yield computed for the parts separately. What is emphasized is that to at least partially remove such

e rrors in going from “whole” to “part”, the methodology what is mentioned in para 7 was adopted by the witness. Ultimately on page 13 of the Report, the outcome is summarized by the witness

635

in Table 13, the contents of which are same as that of the Table-1. The Table 1 has already been reproduced in Para 82 of this Report.

87.

The witness further points out that the availability as determined in this study is only the availability in nature, and not necessarily the water available for use in the upstream area. What is mentioned by the witness is that from this the quantity required for maintenance of eco-system in the highly eco-sensitive Western Ghats and also the quantity required for downstream users will have to be taken into account and only the balance quantity, if any, will be the quantity available for use in the upstream area.

88.

The Examination-in-Chief of Expert witness, Shri Chetan Pandit deposing on behalf of the State of Goa was recorded on 30.08.2016. During the course of his examination he had tendered his Affidavit which was ordered to be treated as Examination-in-Chief. He had also tendered his report annexed to

the Affidavit. According to him, in the Affidavit on page 8 at the bottom there is a table and that in the table there was a typing error. Therefore, he stated that 75% dependable yield for an area

of 2032 sq.km is shown as 3777.3 Mcum and 133.4 tmc, respectively, but it should read 4372.4 Mcum and 154.4 tmc. He also stated that correspondingly, the 50% dependable yield for an area of 1523 sq.km. shown as 4372.4 Mcum and 154.4 tmc should instead be read as 3777.3 Mcum and 133.4 tmc respectively. The witness informed the Tribunal that an identical correction should be carried out in another instance of the same table at page 58 of the report, Table 34-A. The corrections were accordingly carried out.

89.

The witness was cross-examined by the learned Counsel of the State of Karnataka and the learned Counsel for the State of Maharashtra. Certain questions were put to the witness by the Tribunal also to elicit certain facts and information with regard to the details of the entire matter. The Tribunal proposes to adhere to the relevant questions and answers thereto.

90.

In answer to Question No. 2, the witness stated that there is a difference between the estimation of yield for a basin

of catchment vis-à-vis estimation of yield for the project. According to him, the main difference is that for a project, the entire catchment up to the project site will be considered,

whereas while estimating the yield of a basin, some part of the catchment, as the river nears the ocean or the sea, will have to be excluded, because a part of this final reach of the river will be affected by salinity ingress from the sea and also because a part of the catchment will directly drain into ocean/sea without the runoff ever joining the main river, and also because the landscape gets flatter and flatter near the coastal area.

91.

In answer to question no. 3, witness candidly admitted that he had no experience for estimating the yields for a basin, however, the witness enumerated that the main procedure viz. making the Thiessen Polygon, making a rainfall runoff relationship, usually by linear regression, extension of rainfall series to runoff series using this relationship, assignment of probabilities to the discharge series and from there reading the 75% or 50% dependable flow, remain the same.

92.

The Cross Examiner, by putting Question No. 5 to the witness wanted to know as to whether the witness had

suggested that the float measuring site on any of the river should be changed to current meter measuring sites.

The witness

responded that river observations by whatever method are

638

carried out by the River Management Wing and it is in the jurisdiction of that wing to initiate action to modernize the river observations not only from Float to Current Meter but also further to telemetry etc.

It was put to the witness through Q. No. 12, if Goa were to construct some of the projects even that will impact the environment, and that how the witness proposed to reconcile the irrigation development in Goa with protection of environment. In answer, the witness stated that as and when a project is considered for construction, depending on whether it is major/medium/minimum project, there are certain rules and procedures regarding Environmental Impact Assessment to be carried out. Thereafter, the Cross Examiner asked whether his reply would hold good in case of Karnataka's projects also. The witness stated that EIA to be carried out as per the law of the land holds good for these projects also.

93.

It was put to the witness as to whether he had any knowledge with regard to the Ganjim data for the period during

1979-2012 and in answer thereto the witness stated he had used data only up to 2005 and not up to 2012. The witness

emphasized that hydro meteorological data has to be observed when the event takes place and there is no way to verify an observation after the event. It was put to the witness that the discharge data at Ganjim from 1979-80 to 2012-13 published by the CWC in the Water Year Books is a processed and authenticated data and the witness stated that as far as he was aware, CWC itself subjected its own data to various checks, which meant that the data is not taken as validated and authentic at face value even by CWC itself.

94.

The witness in answer to question no. 48 referred to a list of 61 projects, as given in Govt. of Goa, Irrigation Department Master plan for Madei, Mandovi River Basin, a Report by the Panel of Experts (Volume II) May, 1999. The witness further stated that out of 61 projects listed therein, two had already been completed, whereas DPR for six hydro-power projects have been prepared by the National Hydro Power Corporation (NHPC), and the DPR of the remaining 53 projects was prepared by the WRD (Water Resources Department) of the Govt. of Goa. He

further clarified that his advice to WRD, Govt. of Goa was about the general format and the content of DPRs again and not project specific.

640

95.

The learned Counsel for the State of Karnataka drew attention of the witness to the response of the CWC in letter dated 17.02.2016 to the Secretary, WRD, Karnataka to questions at Sl. No. (ii) and (iii) and put to the witness that his answer to Q.No.29 was incorrect. In reply, the witness stated that from the document MARK-KA-1 he had learnt that there were still some sites that continued to use the Float Method.

The witness maintained that CWC had taken up modernization of its hydrologic observation network through a programme called Hydrology Project – 1 (HP-1) and that he was not able to recall the exact year in which Hydrology Project was introduced but according to him it was roughly around 1997, which was followed by further modernization through Hydrology Project – 2 (HP-2), and that this project was under progress when he was superannuated in March 2012. The witness further informed that CWC was in fact, in the process of further modernization by automatic telemetry stations and as at present even the third

phase Hydrology Project-3 (HP-3) was underway, which has been renamed as the National Hydrology Project (NHP). It was put to the witness that in view of the clarifications given by CWC in MARK-KA-1 his adverse comments on page 13 of his Affidavit and page 48 of his report, on the Float Method of measurement of

flows at Ganjim and Collem gauge stations of the CWC, were incorrect and misleading and the witness responded by stating that those comments are not adverse remarks, and maintained that saying that an older technology was less accurate did not amount to making adverse remarks. The witness stated that the data measured by Float Method needs to be corrected by applying an appropriate correction factor before using it.

96.

The Cross Examiner wanted to know from the witness as to whether there was any scientific literature to support the views of the witness that the data generated by Float Method required to be corrected by the data generated by Current Meter Method, and in answer the witness mentioned that the correction factor used by him was computed from the data itself, and as an expert he was competent to exercise the judgment that such correction needs to be applied.

It was put to the witness that he had classified Mandovi/Mahadayi basin into four sub regions and whether the first two sub-regions had plain lands. The answer of the witness

was that the word ‘plain’ is a qualitative description and if it said that the first two sub-regions had plain lands that should not be

taken as if they comprised only of flat land and nothing else; elaborating the said aspect further, it was stated that plain land is the dominant feature in these two sub-regions and the Western Ghats comprise of very tall mountains, which gradually flatten out to sea level in a relatively very short width.

97.

It was put to the witness that the third sub-region mentioned by him is an undulating terrain and in answer thereto, the witness stated that the term undulating terrain means the land where the level is more or less over a long distance but in between the terrain is not flat but has small local ups and downs which should be described “low dissected” which means land which has been weathered by the action of elements but the dissection is relatively low in height.

98.

In answer to Question No.61, the witness emphasized that not only the mankind but other forms of life, flora and fauna, also have a claim to the river water and the flow that is required to maintain a satisfactory state of aquatic eco-system called

environmental flow, which comprises not only a flow rate in terms of cumecs but also includes physical parameters such as the velocity of flow, depth of flow, turbidity, sun light

penetration, temperature and also water chemistry viz., pH, dissolved oxygen and other dissolved substances. It was suggested to the witness that the concept of summer flow, minimum flow and ecological flows are one and the same. The witness emphatically disagreed with the suggestion and stated that minimum flows was a term used initially in the discourse on environmental flows, before the term e-flows or ecological flows, sometimes also called environmental flows, came into use. The term minimum flows refer to a minimum flow rate, expressed as volume per unit to be maintained in the river for environmental objectives.

99. In answer to Question No. 68, the witness reproduced part of para 43(b) of his Affidavit relating to environmental flows and stated that the recommendation of the Expert Body had not clarified 50% or 30% of what, i.e. 50% of 75% dependable flow or 50% of 50% dependable flow or of mean annual flow or anything else and that it was most likely that the Expert Body meant 50%

of the non-monsoon flow. The witness was asked as to whether taking the 75% dependable non-monsoon flows and 50% dependable non-monsoon flows separately, whether he would be able to work out the 50% of non-monsoon flows in

quantitative terms. In reply thereto, the witness stated that he had not worked out anywhere the 75% dependable or 50% dependable non-monsoon flows, and the yield study is about 75% dependable and the 50% dependable yield for the year as a whole. It was further stated by him that the Expert Body has not clarified 50% of what and, therefore working out the arithmetic of 50% of 50% dependable non-monsoon flows, which has neither been recommended by the Expert Body nor estimated by him and therefore is purely hypothetical exercise. The witness asserted that Mahadayi river basin is not a “Typical Indian basin”, and it originates in the Western Ghats, which preserve rich bio-diversity hot-spot. He further mentioned that a relatively small basin, little more than 2000 sq.km. is house to 4 or 5 wildlife sanctuaries and most of the Western Ghats have been identified as eco-sensitive areas.

Further, referring to Exh. GOA/AW-1/2(Colly), the witness mentioned that on page 1 paragraph marked 1, the Float Method is explained and it is stated that because surface velocities are typically higher than mean, or

average velocities can be obtained by applying a correction factor and that this factor ranges from 0.8 to 0.9 and 0.85 is a commonly used value.

The witness further referred to Exh. GOA/AW-1/3(Colly) and stated that document is from the

specifications prepared for the Hydrology Project of the Ministry of Water Resources and after explaining the Float Method, it is stated that Floats are not at all accurate and the error is stated as +/-20% as Current Meters and Acoustic Doppler Current Profiler (ADCP). The witness further referred to Exh. GOA/AW-1/4(Colly) and stated that in the last paragraph, approximately midway, it is stated that “Taking 0.8 of the surface velocity as measured by the float gives an approximate value for the average velocity.” What is asserted by the witness is that on page 38 (Volume 15) of the yield study report prepared by CWC in the year 2003, then CWC had itself stated that “prior to the year 2001, the discharge measurement was by float observations. Thus, the discharge figures up to the year 2000 may have larger error as compared to current meter observati ons”. In view of the above stated position having been accepted by the CWC, the witness reiterated that he had said in his answer to Question No.55 that as an expert, he was competent to exercise the judgment with such correction needed to be applied. It was suggested to the witness that the discharge observation by float

observation up to the year 2000 was satisfactory and in any case, the errors in the float measurements would tend to cancel each other and on an annual basis, the errors may not be significant.

646

In answer to the said suggestion, witness emphatically stated that if a particular method of observation is known to consistently give a higher or lower measurement, then this did not cancel out over a period of time. The witness explained that CWC had explained that they were carrying out observations by float method with due care. But that will not remove the problem with the float method because it measures velocity at the surface which is consistently higher than the mean velocity and to say that over a period of time this error will also cancel out goes completely against the science of hydraulics.

100.

It was put to the witness that the two G&D curves mentioned in CWC Report 2003 were practically identical which proved that the type of consistently higher or lower measurements in the Float Method pointed out by the witness did not happen. In answer thereto, the witness mentioned that the Float Method measures velocity at the surface which is higher than the mean velocity. He also mentioned that this is to be found in text books of Hydraulics. The witness explained that

CWC Report does not say that the G&D curves are “practically identical” but it says that “these do not show any large variation”. The witness emphasized that whether the vari ation is

large or small, is a subjective judgment and if CWC concludes that the two G&D curves do not show large variation then it can mean that either (i) there is some mistake in drawing the graphs, or (ii) while taking the observations the staff was inadvertently making some other error on the negative side which gave an incorrect value than what it should have been.

101.

Again the witness explained that it is not the CWC but the Float Method that measures the velocity at the surface and all velocity measurements are corrected by applying a coefficient to make it representative or mean velocity before being recorded. It was suggested to the witness that the correction in coefficient mentioned in Exh. GOA/AW-1/2(Colly) is to convert surface velocity to average velocity in the Float Method of measurement and that it has nothing to do with the correction the witness had made in his Report at page 56 between Float and Current Meter data. In response, it was stated by the witness that the discharge equals velocity multiplied by cross sectional area of the flow, and thus, a correction factor applied to velocity

or to discharge has the same outcome. The witness stated that he had applied the correction factor to correct the systemic error inherent in float method, which gives higher velocity readings

and since the discharge is proportional to velocity, he had applied the correction factor of 0.84.

102.

In further question, it was put to the witness that systemic error occurred only when there is a change in measurement site or when measuring equipment is damaged, but none of these have been reported by the CWC and in response thereto, the witness stated that he had used word ‘systemic error’ to indicate an error inherent in a particular method of measurement and in the Float Method, the velocity is measured at surface which is known to be higher than the mean velocity of the flow and since this is not a random error or an error made by the person taking the observation, therefore, the word systemic error was used.

103.

The witness has produced Exh.GOA/AW-1/5 (Colly) which is 5 th edition published in 1994 by the WMO. The witness further mentioned that the objective of referring to tables 20.1 and 20.3 of the WMO publication No. 168 was to assess the

number of rain gauge stations and the stream flow stations required in the basin.

After mentioning that para 52 of his Affidavit is a general introduction to the basin, it was stated that

Mahadayi is relatively a very small basin and its width from the top of the mountains to the sea shore is very small, whereas the level above Mean Sea Level at the origin of the river is more than 1000 meters and therefore no useful purpose would have been served by splitting the basin into mountainous and other features for the purpose of assessing the number of rain gauges and stream flow stations required. The witness emphasized that for the purpose of yield study, he would have preferred to use a method called “Isohytes” for estimating the weighted average rainfall and this method is preferable to the method of Thiessen Polygon which has been used by him but has not been used by him because that required more stations, closely spaced. The witness stated that he had not only used the data from IMD but also used the data from some rain fall stations maintained by the organizations under Government of Karnataka and considering all this, he believed that the classification of the basin as mountainous, not for the purpose of an introductory chapter but for the purpose of rain gauge stations required is correct. In answer to Question No. 85, which related to distinct sub-regions

mentioned in the report prepared by the witness, it was stated that WMO Publication No. 168, 5 th Edition of 1994 referred by him is a guideline for setting up the raingauge network, and as

650

per the said guideline, the number of raingauge stations required for Mahadayi basin considering it as mountainous works out to 8, whereas

the next revision of same publication No. 168, 6 th Edition has also retained the same recommendations for the rainfall stations. It was pointed out by the witness that the WMO had not defined what they meant by mountainous, which means that it was left to the judgment of the hydrologists/meteorologists. The witness informed that in his yield study, he had used the data from 13 stations. According to him, more raingauge stations were required irrespective of the

fact whether the basin is classified as entirely mountainous or only some part as mountainous. It was put to the witness that 7 raingauge stations considered by the CWC in its study of 2003 were adequate and there was no reason to increase the number of raingauge stations because the density per raingauge station works out to be 125 sq.km., which is less than the required density for raingauge stations in hilly/undulating physiographic unit region. The witness responded that the WMO guidelines are for the minimum number of stations suggested and that does not bar a consulting hydrologist from using the data from more stations, if it is available. It was further explained by the witness that if the number of IMD raingauge stations was adequate then

there would have been no need for anyone to set up any more raingauge station, but the very fact that different organizations, including some under the Government of Karnataka, have set up more raingauge stations, is simple proof that he is not the only one who thinks that the IMD rainfall stations were not adequate for the purpose of present yield study. With reference to CWC yield study of 2003, the witness stated that he has disagreed with a number of things mentioned in the yield study, and limiting a number of raingauge stations is one major point of disagreement. According to the witness the said study is not applying a correction in the discharge data measured by Float Method, and further disagreement is about the catchment area used by it for the determination of the yield, where it has not excluded the area affected by salinity and where conservation of water is not possible for various reasons. The witness further faulted CWC report on account of runoff factor i.e. ratio of runoff as percentage of rainfall is coming very high and in several places it is more than even 100%, which is not only incorrect, but in fact absurd and the runoff factor being so high more than once

should have, in fact, alerted a hydrologist, as to whether there is some mistake in selection of stations, etc.

652

It was put to the witness that the correction of Ganjim data undertaken by him at page 56 of his report is not supported by any scientific material and therefore not reliable. The witness maintained that the three documents submitted by him do not suggest a correction and merely discussed some difficulties and what was pointed out was the fact that velocities measured by the Float Method are on the higher side is established not only in the document but in Text Books of Hydraulics also. After referring Exh. GOA AW-1/2(Colly), the witness asserted that the surface velocities observed by the Float Method are typically higher than the mean or average velocities by a factor which generally ranges from 0.8 to 0.9, and a commonly used value for correction is 0.85. Having said so, the witness has asserted that it was open to him to simply take this value as quoted in a scientific literature and use it but he had made an attempt to determine the same from the available data and it turned out to be 0.84.

104.

The witness was questioned that average rainfall data of Krishnapura was only available for 10 years i.e. 1979-1988 but

the witness had extended by 17 years i.e. from 1989 to 2005, by filling the missing data, and therefore the data filled by the witness constituted about 63% in the series of 1979 to 2005, and

the witness responded that the arithmetic 17 divided by 27 is about 63% is correct, but that does not mean that 63% of the data was missing and filled because the Krishnapura data is available from 1964 onwards and the complete series was considered. It was put to the witness that Krishnapura data has upwardly impacted his study of re-estimation of weighted average monsoon rainfall up to Ganjim, because he had assigned the second highest weightage and that too based on the data of 63% of the filled up data. The witness denied this suggestion and stated that the method of calculating the weightage is very geometrical. It is explained by the witness that the stations are located on a map; the Thiessen Polygon is drawn and the areas are measured by a planimeter or a suitable devise; and from these areas, the weights are calculated.

105.

A question was put to the witness that if the reasons for exclusion of rainfall of 509 sq.km., is the non-usability of the water, as maintained by him, and then did he mean to say that this entire water in 509 sq.km. cannot be used at all for any

purpose. The answer given by the witness was that there are three reasons why it is necessary to exclude some areas towards the end of the river as it meets the sea or ocean. According to

the witness the first reason was rainfall falling on a lot of this area may not even reach the river channel of Mahadayi river for which the yield is being determined, and it may directly drain out into the sea or ocean through numerous small drains; the second reason was that the final reach of the river as it nears the sea or ocean is affected by salinity due to ingress of saline water from the sea/ocean, due to tidal effect rendering it unusable; the third reason was that the land in this area is quite flat and does not permit the engineering interventions necessary to use the water. Finally the witness added that similar areas had been excluded from the yield in past cases also viz., Narmada, Krishna, Godavari and Cauvery the details whereof have been mentioned in his Affidavit.

106.

It was put to the witness that in this 509 sq.km.
Mahadayi basin in Goa, there is rice cultivation and cultivation of other crops to which the witness stated that he could not say for sure if rice was being cultivated but there could be some rain fed agriculture. It was further put to the witness that he had chosen

to exclude rainfall falling in 509 sq.km., which is a large quantity of water, without conducting any study. After denying the said suggestion, the witness stated that he had studied the report

(Volume 31) submitted by the Panel of Experts, wherein the said figure of 509 sq.km. is mentioned and also shown on a map. The witness emphatically stated that he did not agree that this is a large area. According to the witness, the area excluded in other basins mentioned above is much larger, and in any case the area to be excluded in any given basin will be determined by the topography, and is not an abstract decision. It was put to the witness that

the Report of Panel of Experts is not an

independent report, but a report to boost the case of Goa during the stage of negotiations, to which the witness replied that he had no personal knowledge about the Members or

their

domicile but he knew at least two names who went on to occupy very senior positions in the Central Water Commission and in the Union Ministry of Water Resources and he did not agree with the implicit suggestion that a professional gives a decision based on which State he comes from, and stated that though he himself is a Maharashtrian settled in Pune, but he is exercising his

professional judgment to the best of his ability.

A clarification was sought by the Cross Examiner relating to the answer given by the witness to Question No. 99, and the witness asserted that he had not stated that the water from the

rainfall on this catchment of 509 sq.km, is required for salinity control, but on the contrary, the witness emphasized that he had pointed out that this water may not even reach the main river Mahadayi and may drain out directly into the sea/ocean and then the scenario of salinity ingress is likely to worsen in the future because of expected increase in the sea level due to global warming.

It was clarified by the witness that the water is required in a channel not only for salinity control but also for sediment transport and to maintain the aquatic ecology and bio-diversity. The witness was confronted with relevant part of the report of the Krishna Water Disputes Tribunal and a suggestion was put to him that the excluded area of 1686 sq.km. in Krishna basin constitutes only 0.7% of the total basin area of 2,58,514.7 sq.km., to which the witness also agreed. The witness also agreed to the suggestion that the area of 509 sq.km. excluded by him from the total area of the basin of 2032 sq.km. constitutes 25.05%.

In order to answer question No. 108, the witness

admitted that he had not come across a case where about 25% of the area was excluded from the estimation of the yield of the basin.

657

107.

In answer to Question No.110, the witness stated that he had not read the Irrigation Commission Report entirely and would not expect the Irrigation Commission to make such basin wise recommendations but he was able to recall the extracts from the Awards of the Tribunals for Narmada, Krishna, Godavari, and Cauvery, wherein certain areas were excluded, and that exclusion was not based on the recommendations of Irrigation Commission. It was suggested to the witness that exclusion of 25% of the catchment in Mahadayi from the estimation of the yield is misleading and solely intended for reducing the total yield of the basin but the witness denied the said suggestion. The witness was confronted with letter dated 17.02.2016, MARK KA-1, wherein CWC had replied that velocity area method using current meter for measurement of velocity or Float Method are most common techniques at its sites and therefore his answer to Question No. 29 is incorrect. The witness informed that in the previous evening he had consulted the person concerned i.e. Mr. D. P. Mathuria, Director, CWC as to how was it that the Float

Method still continues to be used and according to the witness the reasons explained to him were that when a new gauge site is to be started, it takes some time to obtain the financial approvals, etc. and procure the current meter and related

equipment and till then the observations are started with float method to save time. According to the witness, there are some sites, particularly in the north east, where the terrain is too difficult for current meter observations, and at these sites also float method continues to be used as a *faitaccompli.* Thewitness was questioned about “Typical Indian basin” and it was suggested to him that Cauvery and Krishna are also not typical Indian basins, since their upper catchments are in the Western Ghats. In answer, the witness explained that there are certain major differences between the Cauvery and Krishna on the one hand, and the Mahadayi on the other, and two most important differences are that in Mahadayi basin there are four Wildlife Sanctuaries and one Bird Sanctuary, within a very small area, and second, the Cauvery and Krishna basins already have a human interventions and river valley projects and in contrast the Mahadayi basin is what is called by Hydrologists a virgin basin. The witness mentioned that the panel appointed by the Ministry of Environment and Forests under the chairmanship of Prof. Madhav Gadgil went to the extent of recommending a blanket

ban on all water resources projects in Western Ghats, and particularly and specifically recommended against any diversion

of water from one basin to another and thus Mahadayi basin is in no way comparable to Krishna or Cauvery.

108.

It was put to the witness that his Affidavit dated 04.08.2016 and the accompanying report estimating the yield by re-estimating the rainfall and correcting the Ganjim gauge data of the CWC are wholly irrational and completely contrary to the hydrological practices, but the witness denied the suggestion and stated that as regards extension of runoff data using a rainfall runoff model and historical rainfall Data, it was a standard hydrological practice.

109.

It was suggested to the witness that the basin planning may involve water to be transferred from a basin to the contiguous basin and in response the witness has stated that the basin planning exercise does not per se include transfer of water from one basin to another, because that involves planning for the donor basin also and such planning involving more than one basin is a separate exercise.

110.

In answer to question No. 123, the witness mentioned

that para 1.3(vi) of the National Water Policy of 2012 refers to

priorities in allocation of water. The witness specifically referred to the l ast sentence of the said clause that “available water after meeting the above needs, should be allocated …”. Thereafter, the witness concluded that obviously, the water of one basin is not “Available water” to another basin, unless such transfer from one basin to another has already been agreed to by the donor party also. It was suggested to the witness that the suggestion made by the witness in para 86 of his additional Affidavit that diversion of Mahadayi water to Malaprabha basin for meeting the drinking water requirement and agricultural requirements as planned by Karnataka violates National Water Policy of 2012 is incorrect and misleading, and the witness stated that in paragraph 86 of his Affidavit what he has stated is that formulating the plans for water management in Malaprabha basin based on some expected diversion from Mahadayi basin when there is no prior consent of the donor parties, is not in accordance with the policy.

111.

It was put to the witness that transfer of Mahadayi water to Malaprabha basin for meeting drinking water

requirement and agricultural requirements, and further transfer of Mahadayi water to Kali basin for production of power from the existing infrastructure of Supa Dam, is justified under the Policy

MARK-KA/4. In answer to the said suggestion, the witness made a clear distinction between three scenarios, i.e. (a) Diversion of water from one basin to another after a share in the donor basin has been allocated; (b) Making a claim on water from one basin to meet a demand, real or perceived, in another basin; (c) There is also the question of consent of all stakeholders. The witness categorically mentioned that as a thinker in water policy issues, he did not agree with the above scenario (b) and it is also not supported by the National Water Policy.

In question No. 132, the Cross Examiner asked the witness whether industrial and commercial development is an integral part of economic development. The witness has replied that he has not questioned the need for economic or commercial development of State of Karnataka and has stated that in paragraph 99 of his Affidavit what he had stated is that “while acknowledging the right of the State of Karnataka to develop the State economy in whichever way they want, I state that the NWP enjoins up on the State of Karnataka to plan the same based on the water resources available in each basin, as repeatedly stated

in the NWP from 1987 to 2012”. It was put to the witness that the suggestion that the State of Karnataka has mismanaged the

water by allegedly supplying 4 lakh liters of water per day to Pepsico is misleading as the total supply is a small quantity of only 0.005 tmc annually. In answer to the said suggestion, the witness stated that the National Water Policy gives some guidelines about the priorities. The priority is a sequence and is not based on the quantities. The witness explained that whether the quantity of water supplied to Pepsico is 0.005 tmc or some other quantity; whether it is small or large, which in any case is a relative term, is not the issue but the issue is as to what should have been the priority, the drinking water or Pepsico, and the people, who might have been benefitted, if this 0.005 tmc water was supplied to them for domestic use, are not likely to think that it is a small quantity. Lastly, it was suggested to the witness by the learned counsel for the State of Karnataka that the contents of his additional Affidavit are not reliable. This suggestion was denied by the witness.

112.

After the cross-examination of Shri Chetan Pandit by Shri Mohan V. Katarki, the learned Counsel for the State of

Karnataka was over and complete, Shri Chetan Pandit was cross-examined by Shri D. M. Nargolkar, the learned Counsel for the State of Maharashtra.

663

113.

In answer to Question No.136, the witness stated that he was associated with the River Management Wing and during his tenure, as additional charge, as Chief Engineer, Narmada and Tapi Basin Organization (Gandhinagar) he was required to discharge all the functions that a Chief Engineer would. The witness has stated that soon after the Tribunal's visit to the sites in December, 2013, he had started working on the matter and visited the Ganjim site, whereupon the fact that a weir which was constructed close to the discharge site, was brought to his attention, and after that it was a continuous process of examining the discharge sites at Ganjim and at Collem, which went on for quite some time, and during that time the discrepancies came to his notice. The witness was confronted with the map at Exh. GOA/152 and requested to identify the portion in the catchment area which drains directly into the sea and the witness had accordingly marked the relevant portions on the map. The witness was confronted with a lecture note given by Mr. R. Azhagesan, Executive Engineer, Upper Krishna Division,

Central Water Commission, Pune, in which under caption “Velocity” it is mentioned that the mean velocity is equal to 0.89 times the surface velocity at the vertical. The witness agreed

with the said fact but further stated that in the same paragraph Mr. R. Azhagesan has also pointed out that “However, we are also conducting experiments on vertical distribution of velocity to verify the assumptions” which according to the witness shows that the author himself admits the factor 0.89 is only an assumption which is subject to further verification through experiments, which he said he is conducting. The witness was again confronted with Document MARK MAH-1 and put a suggestion as to whether the witness agreed that velocity considering while computing the discharge is mean velocity and not surface velocity. In answer to the said suggestion, the witness maintained that this is just an explanation of the theory in a training programme and it does not necessarily mean that the theory as explained therein is being practiced at Ganjim, or Collem, or at any particular site.

114.

The witness was asked a question as to whether the correction factor worked out by the witness is the ratio of average discharges of two different periods and is it not

necessary that the same should always be less than one? The witness referred to two documents MARK-MAH/1 and MARK-MAH/2, and stated that the two documents referred to above

established

firmly the principle that data observed by Float

Method needs to be corrected which is now even supported by the BIS code. He further explained that the ratio computed by him was not an origin of two different periods but also of two different methods during those two periods, and since the average discharges were taken for both the periods, and if the data in each period was representative of the catchment characteristics then the overall discharge by Current Meter Method divided by Average Discharge would always be less than one. It was put to the witness that the correction factor worked

out

by

him

has

nothing

to

do

with

the correction

factor/coefficient/reduction coefficient to be applied for converting the surface velocity to mean velocity and it is sheer coincidence that the correction factor worked out by him has become close to the range in which reduction coefficients are generally arrived at. The witness denied the said suggestion.

115.

The witness did not agree with the suggestion that import of water from Tillari basin would add to the water availability of Mahadayi basin, and further stated that import of water from one basin to another basin can be construed to increase the water availability in the recipient basin only if it was

an import for general use, where it gets added to the common kitty, from which allocations were made to various stakeholders. According to the witness, the case mentioned in the question, namely import of water from Tillari basin is a case of bilateral arrangement between the two parties and for a very specific pre-determined purpose which is for irrigation in a pre-determined area and therefore cannot be construed to increase the water availability of Mahadayi basin.

116.

With the above said answer, the cross-examination of Shri Chetan pandit, by Shri D. M. Nargolkar, the learned Counsel for the State of Maharashtra, was over and complete. With the objective to have clarity on some of the important issues flagged by the witness in his Affidavit and the facts presented in his report, the Tribunal proposed to put a few questions to the witness as the Tribunal was of the opinion that such exercise would enable the Tribunal to reach rational conclusions through the expert advice of the witness, irrespective of the claims or otherwise of the party States in respect of various issues which

are under consideration of the Tribunal. Hence, the Tribunal had put certain questions to the witness.

667

117.

The witness stated that the main requirement of data for estimation of water availability is the river data which comprises the observed flow in the river and any significant abstractions in the upstream. According to the witness, the river data after correction for the upstream abstractions is subjected to a probability analysis.

118.

The attention of the witness was drawn to paras 24 and 25 on page 10 of the Affidavit of the Examination- in-Chief filed by the witness on 04.08.2016 and the Tribunal wanted to know from the witness that as to how he would proceed with the process of estimation of water availability at a specific point along a river for a basin or sub-basin in India, when the hydrological and hydro-meteorological data are not adequate. The Tribunal also wanted to know from the witness as to whether it is possible to estimate the availability of water at specific point along a river for a basin or sub-basin in India if requisite hydrological and hydro-meteorological data are not at

all available.

119.

In answer to the above stated two questions, the

witness stated that if the inadequacy is so high that even the

process of filling a few missing data does not serve the purpose then the entire project would change. The witness explained that the extreme case of inadequate data is - no data. The witness explained that many years ago a British Engineer by name Strange developed a Table, which is known as Strange's table, which helps determine the water availability based on only a few parameters like the catchment area, mean rainfall etc. The witness added that such methods are called Empirical methods and for other aspects of hydrologic analysis viz., flood studies etc., there are other Empirical formulae available viz., Inglis formula, Nawab Shri Bhadaur Jung Formula etc.

and these

formulae may be used, but, Empirical formulae will give only a water availability figure without any attached dependability like 50%, 75% etc.

120.

In answer to question No. 154, the witness stated that after correcting the formula, the 75% and 50% dependable yield for 2032 sq.km and 1523 sq.km. are as below:

Yield		Mcum	Tmc
Runoff over entire catchment.	50% Dependable	4960.10	175.16
	75%	4289.07	151.47

669

Area 2032 sq.km.	Dependable		
Usable Yield Catchment Area 1523 sq.km.	50% Dependable	3717.60	131.30
	75% Dependable	3214.70	113.50

121.

According to him, he requested the officials from WRD, Goa to take water samples from the river and test the same in a lab for salinity and for the first such sample he had personally supervised the operation and guided the concerned persons as to how to take the samples. What is asserted is that the lab test subsequently verified the salinity. According to him, his general observation that the catchment has a thick cover of vegetation in the upstream areas enabled him to form an opinion about possible losses from the rainfall by way of evapo-transpiration and, thereby, the runoff factor expected in this catchment.

122.

In his Affidavit at para 21, page 9, he had stated that
“the river flow measurement is an instantaneous measurement i.e. at an instant of time, but it is required to be taken as representative of the flow over a duration of time, typically 24 hours.” However , in WMO-1044-Manual on Stream Gauging, stream flow or discharge and streamflow measurement are

670

defined and the attention of the witness was drawn to said Manual. It was put to the witness that stream flow, or discharge, is defined as the volumetric rate of flow of water in an open channel, including any sediment or other solids that may be dissolved or mixed with it and is usually expressed in dimensions of cubic meters per second (m 3 /s) but stream flow cannot be measured directly and must be computed from variables that can be measured directly, such as stream width, stream depth and flow velocity.

123.

It was put to the witness that “river flow

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variables such as depth are instantaneous in nature whereas instantaneous discharge is computed by using observed instantaneous gauge, and the rating curve developed for the site. Therefore, the witness was requested to elaborate as to what he meant by “river flow measurement as an instantaneous measurement”. In reply, the witness stated that strictly speaking no measurement is instantaneous and any act of reading any instrument takes a finite time. However, it was explained by the witness that it is a colloquial expression that river flow

measurement is instantaneous in the sense that even though the actual act of measurement by moving the Current Meter at various locations across the river and taking the readings etc., it takes a finite amount of time but at the end of it, the measurement is recorded as cubic meters per second at an instant of time. The witness also explained that if a river gauge is read at 0830 hrs, and discharge is computed, one would not call it as the river flow during the previous 24 hours or any other duration and it would be considered as the river flow at 0830 hrs, and in that sense the river flow is an instantaneous measurement. The witness has mentioned in his Affidavit in para 23 that the hydrologist making such assumption has to make certain decisions on acceptability or otherwise of various data; the procedure to be followed etc. based on the Hydrologist's knowledge and experience. The Tribunal felt that all hydrologists may not be highly knowledgeable and experienced and in such circumstances it may not be appropriate to leave the process of checking the data and the choice of procedures or methodologies to be adopted for estimating hydrological inputs to be considered

during decision making process at the sweet will of the Hydrologists. The Tribunal further wanted to know as to why the Tribunal should not insist on following the procedures laid down

in standard codes or guidelines such as; (a) relevant Codes Bureau of Indian Standards; (b) Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects published by the Ministry of Water Resources; and (c) State-of-Art Report on Development of Hydrological Design Aids prepared under Hydrology Project-II.

In answer thereto, the witness mentioned that we are still a long way off from eliminating the role of human judgment in practice of hydrology. The witness mentioned that when an “expert system” software is developed; or guidelines are developed; or Standard Operating Procedures are developed; in all such cases one or more experts are consulted and their judgment, their way of thinking, their approach is translated into a software or a guideline or an SOP and anyone using that software or guidelines or SOP, thereafter, is actually using the judgment of the people who wrote that software etc. and therefore there is elimination of judgment. Moreover, it was pointed out by the witness that the guidelines can only give a broad guidance and guidelines cannot go into the

details, such as which probability distribution to use; which method to use for determining the parameters; etc. and all that is left to the judgment of the consulting hydrologist.

673

124.

The Tribunal had noticed that in paras 27 and 28, pages 11-12 of his Affidavit, the witness had mentioned about inadequate number of CWC gauging stations on river Mahadayi and its tributaries, but the State of Goa, Karnataka and Maharashtra had reported observed hydrological data at (i) Daucond from the year 2010 to 2013;(ii) Khadki from the year 2010 to 2012; (iii) Kudchire from the year 2009 to 2013; (iv) Paikul from the year 2009 to 2013; (v) Chapoli from the year 1985-86 to 1991-92 and from 2000-01 to 2013-14; (vi) Virdi from the year 1986 to 2004 and from the year 2006 to 2011. However the Tribunal noticed that the above mentioned data had neither been analyzed for consistency checks nor used for assessment of water availability. Therefore, the Tribunal wanted to know from the witness as to why the data, observed and collected by the respective State Governments, cannot be used for assessment of water availability. The answer to the said question by the witness was that the table given in the question relating to gauging stations of Doucond, Khadki, Kudchire and Paikul, the data was

available only from 2009 to 2010 onwards, and that he had used data only upto 2005, and therefore the data of these stations was ruled out. The witness further mentioned that at Chapoli, the data available is one chunk from 1985-86 to 1991-92, and

another chunk from 2000-01 to 2013-14, and as there was significant gap between 1992-93 to 1999-2000, in the second chunk, the useable data for him was only upto 2005, whereas in case of Virdi, the data for his purpose was available from 1986 to 2004, hence he had decided not to use the data after 2006. He further asserted that he did not recommend developing of rainfall runoff relationships for small catchments because as the catchments get smaller and smaller the relationship becomes; less and less stable.

125.

It was noticed by the Tribunal that in the table given in para 27 at page 11 of Affidavit of the witness, the information relating to minimum number of stations and actual number of stations in Mahadayi basin had been furnished by him. The Tribunal found that the 4 th column of table indicates the actual number of stations in Mahadayi basin, wherein the witness had indicated six stations for precipitation and one station for streamflow. It was also noticed by the Tribunal that from the information included in various records filed by the States of Goa,

Karnataka and Maharashtra, it was apparent that the number of raingauge stations in the basin is much more than six and even in his report, the witness had included information about

availability of data of 18 stations in Table 2 and Table 3 on page 60 and page 61, respectively. But out of available data for 18 stations, the witness had used the data of 13 raingauge stations, as is apparent from the table No. 34 on page 94, and figure 3 on page 96.

Therefore the Tribunal wanted to know from the witness as to why complete information regarding the rain gauge stations and stream gauging stations, had not been provided and that only limited information in respect of rain gauge stations of IMD and Stream gauging stations of CWC had been provided. In answer to the said question, the witness mentioned that most of what is in the first Affidavit had already been submitted much earlier on 15.09.2015, and much later, when the yield study report by Dr. V. Jothiprakash was withdrawn, and he had started working on the yield study report some time in July, 2016, the focus was on doing the yield study with the data which had already been assembled, and perhaps for this reason a detailed data inventory does not appear in his yield study report. The witness admitted that he was not aware of the methods or

techniques used for discharge measurement at the sites of Doucond, Khadki, Kudichire and Paikul, which were established and maintained by the State of Goa. The witness could not offer any comments on the question whether he was satisfied that the

discharge data observed at four discharge measurement sites namely; Doucond, Khadki, Kudichre and Paikul by the State of Goa are as per the standard practice and can be considered as reliable. The witness was confronted with the information culled out from the data submitted by Central Water Commission (vide report titled “Consistency Analysis of Flow Data in Mahadayi Basin” filed on 01.12.2014) and that by the State of Goa in compliance with para 4 of the Order dated 03.09.2014 passed by the Tribunal on 22.12.2014. The said data forms parts of Question No.63 put to the witness.

126.

It was noticed by the Tribunal that there were wide variations in annual runoff in terms of depth in mm, at different sites and in particular, the variations in the annual runoff in mm, in respect of Khadki, and Kudichire sites maintained by the State of Goa during the years 2012-13 and 2013-14 and the variations were on very high side. Therefore, the witness was asked to offer his comments on the variations noticed by the Tribunal. The reply given by the witness was that he had not analysed the data at

any station beyond 2005 and had not analysed the data at Khadki and Kudichire for any duration, and therefore he was not able to explain the variations in annual runoff at different sites.

677

127.

The Tribunal further noticed that in para 27 at page 1 of his Affidavit, the witness had indicated that six precipitation stations are required for catchment area of 2032 sq.km. of Mahadayi basin on the basis of the Table for “Recommended minimum densities of stations (area in km 2 per station)” provided in the World Meteorological Organization (WMO) publication titled “Guide to Hydrological Practices”. On going through the guide to Hydrological Practices, the Tribunal found that the guidelines can also talk about the minimum network that will avoid serious deficiencies in developing and managing water resources on a scale commensurate with the overall level of economic development of the country. Further IS 4987: 1994 – and the observations made in the WMO publication while identifying minimum number of stations had made certain recommendations and whether the witness had followed the same. The answer of the witness was that the contents of paragraph 27 on page 11 of his Affidavit were based only on the WMO Publication No. 168 downloaded from the CWC website,

and he had not taken the IS 4987:1994 into account while writing the said paragraph. What was claimed by the witness was that the network of raingauges had already been set up by other

agencies and he was only required to use the data if found reliable and useful. It was noticed by the Tribunal that in para 30 on page 12 of his Affidavit, the witness has mentioned that he had personally visited various locations in the Mahadayi basin to obtain a clinical picture of the basin from a hydrologist's perspective. The Tribunal called upon the witness to inform it as to what precisely the witness meant by clinical picture of the basin from a Hydrologist's perspective, and how the above stated clinical picture of the basin differs from understanding the topography and land use, as already mentioned by him at para 17 on page 8 of his Affidavit. In answer, the witness mentioned that the term "clinical picture" is borrowed from the world of medicine and refers to such observations and conclusions, which an expert might draw, which cannot be quantified and cannot be expressed in terms of numbers. As regards, what specific information and data had been gathered during his visits and how the information and data have been used, the witness replied that the same had been dealt with at length, in answer to question number 156. In para 31 on page 13 of his Affidavit, the

witness mentioned that the Float Method is the least accurate, and therefore the accuracy of discharge data prior to the year 2000 is questionable, however, it was noticed by the Tribunal

that Measurement of velocity of flow by using float is an accepted procedure, as is evident from the fact that after going through the International Standard Code “ISO 748:2007 Hydrometry-Measurement of liquid flow in open channels using current- meters or floats”, and this code has been adopted by Bureau of Indian Standards as IS 1192:2013.

It was further noticed by the Tribunal that IS 3911:1994 also dealt with Surface Floats – Functional Requirements. Moreover the Central Water Commission in its report “Consistency Analysis of Flow Data Mahadayi Basin” (Volume 99) has reported that the cable way was erected at Ganjim site in the year 2001 and that the discharge observations were carried out with current meters using boat and cableway during monsoon at higher stages and by wading during non-monsoon at lower stages. The CWC had also stated that before the year 2001, float was used for discharge observations during higher depth. Under the circumstances, the Tribunal was of the opinion that Float Method was used due to lack of facilities for the use of current meters at higher flows and

that the same was in accordance with the provisions of Bureau of Indian Standards Code IS 3991:1994.

Therefore the Tribunal

wanted to have opinion of the witness as to what could have been the option other than use of Float Method during high flow

prior to the year 2001, when there was no cableway. In response, the witness clarified that he had not challenged the use of Float Method and had not discarded the data collected by Float Method. The witness mentioned that in fact he had used CWC discharge data from 1979 onwards which, till the year 2000, was by Float Method, and therefore, his comments on the Float Method may not be taken as rejection of Float Method. The witness agreed that in certain stations, the Float Method may be necessary and Float Method continues to be used when a new site is opened and current meter is yet to be procured. The witness further explained that there could be one more reason for continuing to use the Float Method and that is financial constraints, because Current Meter itself costs some significant amount and requires frequent re-calibration in specialized hydraulics laboratories, and all this requires money and trained people, and probably non-availability of these were the reasons why upto 2001 the discharge measurements were continued by CWC by Float Method.

128.

The Tribunal had noticed in para 32 on page 13 of his Affidavit that the witness had mentioned that construction of this weir would change the gauge-discharge relationship at Ganjim

681

and that he had found that CWC had not made necessary changes in its observation procedures, i.e., discharge measurement procedures taking cognizance of the construction of the said weir. The Tribunal wanted to know from the witness as to why changes in the observation procedures are necessary because of likely changes in the gauge discharge relationship and would the development of a revised gauge discharge relationship not serve the purpose and what should be the changes in observation procedures. In answer, the witness maintained that construction of weir causes water to head up behind the weir and this extends to some distance upstream. According to the witness, this heading up of water is known as back water profile and when the gates of weir are closed, as they are during the

lean season, it creates a stagnant pool of water behind the weir and in that situation no gauge discharge relationship will hold true. The witness explained that in his opinion this is what is happening at Ganjim site post 2005, and considering the fact that the gates of the weir are closed during lean season, the only solution is to shift this site to suitable location upstream, beyond the effect of back water profile.

682

129.

It was noticed by the Tribunal that in para 34 on page 13 of his Affidavit, the witness had stated that when the CWC staff is not adequately trained and adequately supervised for taking correct observation in a correct manner, then there is every possibility that before 2006, the incompetence and/or lack of supervision persisted and therefore the data prior to year 2006 is suspect. However, it was also noticed by the Tribunal that in para 17 on pages 56-57 of his report, the witness had considered observed data at Ganjim for the period from 2001-2005 as correct. Therefore, the witness was requested to explain this contradiction.

The witness explained that he had stated in paragraph 33 that the fact that CWC failed to take cognizance of the construction of a weir raised a strong doubt on the competence of the observation staff and the quality of supervision. According to the witness, he was perplexed by the fact that after 2005 i.e. when a weir was constructed, the CWC staff had proceeded to take discharge observations as if nothing

had happened. The witness further explained that there is no contradiction in using the data before 2005, because, as he had stated that a hydrologist has to do the best possible with the available data, and it is not acceptable position for the

683

Hydrologist to say that yield study will have to wait till data of his satisfaction becomes available.

130.

In para 39 on pages 15 and 16 of his Affidavit, the witness stated that the river valley projects inflict a huge cost on the people; there are financial costs in terms of money; there are environmental cost like diversion of forests land for non-forest purposes and changes in the flow pattern in the river, which further impact ecology; there are social costs in terms of people displaced from their homes and farms and there is loss of livelihood; etc. and therefore, the witness opined that in case of doubt about the accuracy of water availability assessment, it is preferable to err on the safer side i.e., on the lower side. The Tribunal wanted to know from the witness as to why he felt that various standard practices for assessment of water availability are not based on rational approach and that they cannot be relied upon for the purpose of water resources assessment and that the financial considerations should decide the quantum of available water resources for planning purposes. The Tribunal felt

that the approach mentioned by the witness in para 39 would lead to non-optimal planning of scarce water resources. In reply, the witness mentioned that his comments on paragraph 39 as

reproduced in question 170 have been misunderstood. He asserted that it is a fact that river valley projects inflict a huge financial and environmental and social costs and another aspect of river valley projects is, that they are irreversible and mistakes cannot be repaired. Therefore, according to the witness decisions on a river valley projects need to be made with great care and it is his experience that projects that underperform are in fact counter-productive, in the sense that it builds a huge public opinion against such projects. The witness mentioned that there are comments, on regular basis, in the popular media, newspapers etc. that such and such State has constructed so many large dams, and yet the water problems remain unsolved. The witness elaborated that in his Affidavit he has stated that hydrology is a very crude science and therefore, predicting the future water availability, based on the past rainfall and river flow amounts to saying that the natural processes are constant with respect to time, but in reality we are painfully aware that natural processes are not constant and in fact climate change science

tells us that the future is going to be significantly different from the past. The witness therefore claimed that under those circumstances, a hydrologic yield study for predicting the water availability in the future is very difficult exercise, and must be

approached with great caution and that it is absolutely necessary to conserve the scarce water resources, not only for the mankind, but also for the ecological services the rivers provide. It was noticed by the Tribunal that on page 43 of his Affidavit, the witness had mentioned that drawing of isohyets requires the raingauges to be many and evenly spaced all over the catchment and that this condition is rarely satisfied. Further, the witness explained in the map annexed to his report at figure 3 on page 96, that it can be seen that the rain gauges of Amagaon, Chapoli, Kotni Dam, Gavali, Jamagoan and Krishnapura are located relatively close to each other in a small segment of the catchment in the north-east of the basin whereas Valpoi is located even farther away from Krishnapura and then Ponda, Quepem, and Sanguem are located even farther away. The witness further stated that Mapuca and Panjim in the east are also located very far away. The witness claimed that he would not attempt to draw Isohytes in the Mahadayi catchment in the region roughly to South-West of a line joining Kankumbi and Krishnapura, because he considered raingauges in this region to

have located too far away from each other for the purpose of drawing Isohytes.

686

131.

The attention of the witness was drawn to pages 49 and 50 of his Affidavit and it was pointed out that in view of what is stated on those pages, the witness had selected a very simple linear equation with total monsoon rainfall as independent variable, and the total monsoon runoff as dependent variable, however in para 22, page 9, it is stated by him that the relationship of the runoff to rainfall is complex, and for a given quantity of rainfall the resultant runoff could be different at different times. The Tribunal prima facie was of the view that preliminary analysis of discharge data of Ganjim site supplied by the Central Water Commission and the high resolution gridded daily rainfall data of India Meteorological Department also exhibit high degree of variations in rainfall and runoff. Therefore, the Tribunal had requested the witness to justify the adoption of the simplest form of rainfall and runoff relationship, using the total “monsoon rainfall and total monsoon runoff through linear regression analysis” which in his view had no basis for

whatsoever in the hydrometeorology.

Witness was further

requested to inform the Tribunal as to why model using data at shorter interval, say, monthly data had not been considered more appropriate. The witness in his answer mentioned that the observation that complex and laborious computations, many

checks, graphs etc. do not necessarily lead to better results was drilled into their heads, the 1986-87 batch of M.Tech in Hydrology, by Prof. Nash, a father figure in the field of hydrology. According to the witness, better results come from better insight into the science of hydrology and his observations were related to not doing too many statistical tests, and were not related to the choice of model for rainfall runoff relationship. The witness explained that unfortunately, the community of hydrologists has not made as much use of modern computers as have been made by their counterparts in the field of meteorology. The witness enumerated new models introduced as well as proposed, and referred to a book written by Prof. Vijay P. Singh which runs into two volumes which is simply a compilation and review of many different models. The witness stated that this is still in the “Lab” stage and it is yet to make the final journey from lab to field. According to the witness, the practice of hydrology continues with rather simple techniques like linear regression for monsoon or annual rainfall and runoff and as a Hydrologist, he is rather unhappy with this situation and had expressed himself thus in

various seminars, workshops etc. The witness also mentioned that as for the NAM model used by the DHI in their software, the same is a rather simple model and the software Mike-11 was

originally developed by DHI for dam break analysis, and was later modified for flood forecasting and also for hydraulic river modeling. The witness stated that in flood forecasting, the main issue is to get the peak runoff and the time of its occurrence correct and the volume of flow is not the issue of interest in flood forecasting, but in contrast for the yield study the key issue is the volume of flow and not the peak flow or its time of occurrence. The witness asserted that he did not consider NAM model suitable for this purpose.

132.

In question No. 173, the attention of the witness was drawn to paras 179L and 179M of the amended Statement of the Case of the State of Goa, filed on 23.04.2015, and it was put to the witness that the Tribunal finds that the yield of Drainage Basin has been defined in the IS:4410(Part XI/Sec2)-1972 at para 2.66 as “Total vol ume or flow from a drainage basin for a long stipulated period of time, for example ‘annual yield of a drainage basin’ is mean annual runoff” and that the term yield of a river has been clearly defined in the report of Cauvery Water Disputes

Tribunal stat es that “The yield of a river system is the annual virgin flows at its terminal site”. The Tribunal found that in the context of river flow, annual yield is synonymous to annual runoff

or annual flow, and therefore the witness was requested to inform the Tribunal as to whether he agreed with the above mentioned definition of yield, as given in the Indian Standard code or that included in the report of the Cauvery Water Disputes Tribunal, and in case he disagrees to detail the reasons for disagreeing. In answer to the said question, the witness stated that in paragraph 179L and 179M of State of Goa's amended Statement of Case filed on 23.04.2015, there is a reference to the said report which is perhaps an yield report prepared by Prof. V. Jothiprakash, and in that report the terms run-off and yield were used in a particular manner. The witness explained that he used the term runoff to indicate the water accruing from rainfall over the entire catchment, and the term 'yield' to indicate the usable part of the run-off by excluding some part of the catchment, from where the run-off cannot be utilized for various reasons. The witness also mentioned that CWC did not use the terms the way Prof. Jothiprakash had used them, but the underlying concept that a part of the catchment which directly drains into the sea/ocean; where the rivers may be saline due to tidal effects;

where the topography may not permit construction of dams and barrages for utilization of waters holds true i.e., the terminology may differ but the concept is same. The witness added that IS

4410 (Part XI/Sec2)-1972, Mark 13, defines the yield of drainage basin as “Total volume or flow from a drainage basin for a long stipulated period of time, for example ‘annual yield of drainage basin’ is the mean annual runoff.” The witness further stated that in the photocopy of page 9, the heading of the concerned paragraph 2.66 is qualified with an ‘*’ mark indicating that probably there is a foot note, but this footnote is not seen in the page 9. According to the witness, there are two issues i.e. it defines the yield as mean annual runoff, and mean is arithmetic mean. What was stated by the witness is that if the data follows normal distribution then arithmetic mean is the same as 50% dependable value, whereas natural data usually is very close to normal distribution, but for the purpose of water resources planning in India traditionally 75% dependable yield is used which is a deviation from what the IS Code defines. According to the witness the second issue is, as to what is the definition of a drainage basin. After informing the Tribunal that in IS Codes there is no distinction between a tributary, which meets a larger river at a specific point vis-à-vis a large river which outfalls into

the sea/ocean and the river which outfalls into the sea/ocean would pass through a delta and estuarine phase, whereas a tributary has no delta, no estuary and therefore obviously the

691

definition of catchment for the purpose of allocation of utilizable yield of a river which is a tributary, will have to be different from the definition

for a river which may be small, but is an

independent river out falling into a sea or an ocean. The witness claimed that from an internet search he had found that without necessarily modifying the definition, in earlier cases also while allocating the waters of an independent basin, the ‘terminal point’ has been taken some distance upstream of the final outfall of the river.

133.

On 7.10.2016, the witness had given supplementary

reply to question no. 163, and in that the witness had stated that Khadki site is located on the main river Mahadayi, approximately 7 kms, upstream of the Ganjim site and there are no major diversion works between the Khadki site and Ganjim site and therefore there is no logical reason for the flow at Khadki to be more than the flow at Ganjim. The witness stated that the flow at Khadki for the years 2010-11 to 2013-14 is not only more than

the flow at Ganjim but in 2011-12 and 2012-13, it is significantly more and therefore in his opinion, this data is not reliable. The witness explained that the Kudchire site is located on river Bicholim which is a tributary of Mahadayi and meets the main

river Mahadayi downstream of Ganjim site.

The witness

mentioned that one way to form an opinion about the flow observed at Kudchire site is by comparing it with the rainfall in its catchment for the years concerned and this data is not readily available and therefore he expressed his inability to give any opinion about reliability of the data at this site. The witness claimed that he was informed by the WRD Goa Engineers that both these sites have been newly established under the Hydrology Project and, perhaps in 2010 to 2014 the observation procedure was yet to stabilize.

134.

In Question no. 175, it was pointed out to the witness

that it had been mentioned by him at page 57 of his Affidavit that the ratio was found to be 0.84, which means the discharge as measured by float should be multiplied by 0.84 to correct it and bring it at par with the data measured by the current meter method, however, it was noticed by the Tribunal from Table 33 on page 93 of his Affidavit that the ratio of “ Q float Correc” and

“Q Obs.” is about 0.81 and not 0.84. It was also noticed by the Tribunal that para 7.2.5.1 and 7.2.5.2 of IS 1192:2013 (ISO 748:2007) describes the method for determination of velocity. Accordingly, the witness was requested to explain the

inconsistency in his report in respect of the value being either 0.84 or 0.81, and also to inform as to whether the provisions in IS 1192:2013 in respect of coefficient of surface float had been kept in view. The explanation given by the witness was that computation of the correction factor and its application to the Float data was all built into the same Excel spread sheet, which means once the spread sheet was programmed, it calculated the factor and also applied it to the Float data without any additional intervention or command by the user. It was mentioned by the witness that he had found that CWC 2003 Report had the discharge data from 1979-1984. According to the witness he had disagreed with CWC computations, and therefore, the outcome in their study and that the disagreement continues, but that does not mean a total rejection of the entire report as if it was a monolith. The witness explained that since there were no convincing arguments for rejection of the data, he used it and further revised his computation and on inserting the 1979-1984 discharge data in the spread sheet the factor automatically changed from 0.84 to 0.81, and the spreadsheet also applied this

factor without any intervention from him and completed the calculations.

694

A question was put to the witness as to whether he had examined the data sheet of CWC in respect of observations during the period from 1979-2000 to check whether necessary coefficient as prescribed in ISO 748:2007/IS 1192:2013 (Mark 14) had been applied as multiplication factor by CWC to convert the surface velocity observed by float measurement into the mean velocity or not. In answer to the said question, the witness categorically mentioned that he had not checked the CWC's original data sheets at the site. On examination of the data sheet of Central Water Commission in respect of daily discharge data, particularly, the statement related to velocity observation by float, it was found by the Tribunal that Central Water Commission had used suitable multiplication factor and from the data sheet of one particular date i.e. 3.7.2001, it was noticed that 0.89 had been used as multiplication factor to convert the observed surface velocity into the mean velocity, therefore the opinion of the witness was sought by the Tribunal that the

exercise to correct the discharge for the period from 1979 to 2000 had been undertaken by the witness without thorough examination and was uncalled for.

In answer to the said question, the witness mentioned that on the data sheet 03.07.2001, a date when he believed the observations were

695

already being done by the Current Meter Method but the data sheet says that a factor of 0.89 has been applied, and he had no further comments to make on that.

135.

The attention of the witness was drawn to page 58 of his Affidavit and it was put to him that it was apparent that he was not at all confident about the findings presented by him in the report and therefore how did he expect the Tribunal to accept his findings and the recommendations. After denying the inference as suggestion in the question, the witness stated that comments made by him in the paragraph quoted in the question should be read together with an earlier comment made by him on page 36 of his report, whereas in third paragraph “Hydrology is an inexact science, in the sense hydrologic computation cannot be made with the same exactness as – say – computation of the trajectory of a ballistic missile, or voltage and current in a circuit”. The witness stated that the decisions are likely to be taken by appropriate authorities based on his yield study report, which will impact the lives of millions of people, impact the environment,

and also involve expenditure of large sums of money.

The

witness stated that Thiessen Polygon, Linear Regression, are

methods routinely used by the Hydrologists and he has also used

them but that does not change the fact that neither of these methods have any basis in the science of hydrology, because Thiessen Polygon concept arises from a branch of mathematics known as “Proximity Analysis” and merely divides an area into polygons in which all the points are closest to a certain point in each polygon. There is no basis to assume that the rainfall at all points in such a polygon is the same as the nodal point in that polygon. The witness mentioned that Linear Regression is a procedure from statistics and fits a straight line to a set of data of two variables by minimizing the square of errors between observed values and predicted values, without any reference to the cause and effect relationship between the two variables.

136.

The witness further mentioned that the hydrologists use both these methods because at the moment nothing much better is available but the inherent deficiencies in these methods cannot be ignored. The witness further added that as regards use of hourly data, traditionally the same is used for flood studies and not for water availability study and since he has not made any

flood study of Mandovi basin, he had not examined the continuity, and reliability of the hourly data.

697

137.

The attention of the witness was drawn to the observations made by him on page 58 of his Affidavit as the Tribunal had found the same to be disturbing and a matter of serious concern. The witness was requested to inform the Tribunal as to where the problem lies - with the study programmes or with the teaching system or with the professionals' training or something else, and what measures are necessarily required to improve the situation.

The witness explained that there is no lack of hydrology talent in India and many of the Indian Universities, for example, the IITs teach Hydrology at Post Graduate level, but the problems are inherent to the science of Hydrology and although in India, Hydrology is traditionally taught as a specialization in Civil Engineering, it is now recognized as a group of Sciences known as "Earth Sciences". All Earth Sciences have certain inherent limitations arising out of very large data sets; from which only a limited sample is available; spatially distributed data; inadequate

understanding of how the nature behaves; having to predict the future based on the past despite being fully aware that the natural processes are not constant. It was explained by the witness that an example of limitations of Earth Sciences is our inability to predict earthquakes and that this is not due to any

inadequacy in training programmes or teaching etc. Further, he mentioned that the School of Earthquake Engineering in IIT, Roorkee is one of the finest in the world but the problem is that natural process leading to earthquakes have not yet been fully understood and it is very difficult to make observations of the causative factors which result in earthquakes. The witness expressed that Hydrology has progressed somewhat better but suffers from the inherent limitations and in the foreseeable future will continue to suffer from the inherent limitations of Earth Sciences and Hydrology requires analysis of very large data sets which was difficult without the computers, and in fact, the science of hydrology has started making some appreciable progress only after computers became available to civilian users, which in India means approximately 1975, but before that, hydrology was practiced mostly by Empirical formulae and sometime in late 1990s, the desktop computers became powerful enough to undertake hydrological analysis.

This is the sum and substance of the evidence of witness, Shri Chetan Pandit (AW-1).

699

Oral evidence of RW-1

Karnataka

138.

Prof. A.K. Gosain for the State of

Having discussed the evidence of expert witness Shri Chetan Pandit, AW-1, examined on behalf of the State of Goa regarding availability of water in Mahadayi Basin, it is time to discuss the Affidavit of Examination-in-Chief filed by Professor A.K. Gosain, RW-1, on behalf of the State of Karnataka.

139.

In paragraph 1 of his Affidavit dated 15.9.2015 (Volume 166), the witness has stated that he is a Professor of Civil Engineering at the Institute of Technology, Delhi, and his expertise for three decades in the field of Water Resources Engineering is derived from his education in the subject of Civil Engineering leading to Ph.D. thesis in Hydrology, teaching experiences in the area of “Water Resources Engineering” i.e. Civil Engineering Department of the Indian Institute of Technology, Delhi, research projects, guiding the Ph.D. students

in Water Resources Engineering and research publications in National and International journals. The witness has annexed his Bio Data as Annexure A to his Affidavit.

700

140.

The witness has stated in paragraph 2 of his Affidavit that the Water Resources Department of the Government of Karnataka approached him in the month of October 2013 requesting him to study the yield of inter-State of the Mahadayi Basin, and on studying the materials given to him which included the Central Water Commission's draft report of 2001 and the final report of March 2003 and the estimations made by the National Water Development Agency in 1989, he agreed to conduct further studies in close association with Mr. Anil Kumar Goyal, who retired in 2011 as the Director (Hydrology), Central Water Commission.

141.

The witness has proceeded to mention that he himself with the assistance of Shri A.K. Goyal, who was M.Tech. in Hydrology from I.I.T., Roorkee, conducted the study on the water availability in the Inter-State Mahadayi basin and estimated the yield of the Basin lying in the State of Karnataka and the entire basin spread across the States of Karnataka, Maharashtra and

Goa, having a catchment area of 2032 sq.km. What is emphasized by the witness is that Shri Goyal assisted him in respect of the following aspects:-

701

a. Checking of the consistency of the rainfall and runoff data; and

b. Re-establishing rainfall-runoff relationship.

142.

The questions considered by the witness are mentioned by him in paragraph 4 of his Affidavit. In paragraph 5, the witness claims that he had independently cross checked the various aspects on which he had sought for and had received technical computations from Shri Goyal and that his study is in the form of his report titled as “The Yield Study of Mahadayi Basin”. The witness has produced his report dated September 8, 2015 as Annexure B to his Affidavit. The witness has reproduced the conclusions of the study in paragraph 6 of his Affidavit. At page 7 of his Affidavit, the witness has stated that in Case-I, he has extended the annual gross yield series of Mahadayi basin for the period 1998-99 to 2012-13 based on CWC methodology and by adopting regression equation used in CWC’s Report of march 2003 i.e, RO = 0.87891*P – 49.6451.

702

At page 8 of his Affidavit the witness has stated that in Case-II, he has extended annual gross yield series of Mahadayi basin for the period from 1998-99 to 2012-13 based on CWC methodology but using a revised regression equation based on runoff data of Ganjim measured by CWC for the period 1979-2012, the revised regression equation being RO = 0.7368*P + 432.28.

143.

According to the witness, since long term continuous flow data of 34 years was available at Ganjim Site, the same is used for calculating the 50% and 75% dependable gross annual yield at the Gangim and run-off data observed at Ganjim Site is the net run-off after abstracting utilizations upstream. The witness has stated that, to get the virgin run-off at G&D Site, the upstream utilization has been added, to the net run-off at site, whereas for the Karnataka catchment, the annual yield has been worked out based on catchment area proportion method with respect to the yield at Ganjim. The witness has explained that Table 11 on page 9 provides summary of 50% and 75%

dependable gross annual yield for Mahadayi basin at Ganjim and

703

for Karnataka part of the catchment, which is reproduced hereunder.

Table-11: Annual Gross Yiled in Mahadayi, Ganjim and Karnataka part of the Basin

Depend-ability	Annual Gross Yield For entire Mahadayi Basin (1928-29 to 2012-13) – Using CWC's Regression Equation	Annual Gross Yield for entire Mahadayi Basin (1928- 29 to 2012-13) – Using Revised Regression Equation	Annual Gross Yield for entire Mahadayi Basin (1928-29 to 1997-98) – As per CWC Report 2003	Annual Gross Yield At Ganjim (1979-80 to 2012-13)	Annual Gross Yield at Goa/ Karnataka Border based on catchment area propor-tionate w.r.t. Ganjim (1979- 80 to 2012-13)
	Case-I	Case-II			
50% (Mcum)	6361	6321	6234	3481	1483
75% (Mcum)	5784	5838	5652	2896	1234

50% (tmc)	224.61	223.20	220.13	122.90	52.37
75% (tmc)	204.24	206.14	199.58	102.25	43.57

What is emphasized by the witness is that 50% and 75% dependable annual gross yield of Mahadayi basin worked out by using the extended data with the old R-R model is not very

different from the one obtained by revising the R-R model after incorporating the additional run-off observations, and therefore, it is recommended to use the 50% and 75% dependable gross annual yield for Mahadayi basin as 6321 Mcum (223.20 tmc) and 5838 Mcum (206.14 tmc) respectively, since it is the outcome of a correct procedure.

144.

If one refers to the yield study of Mahadayi basin Report of the witness, it becomes evident that the witness has carried out the study, which is aimed at extending the assessment of the annual gross yield of Mahadayi basin at 75% and 50% dependability, by taking into account the additional available hydrological and meteorological data and employing the procedure deployed by the CWC. In para 2 of his report, the witness has described Mahadayi basin in great detail. The witness has informed the Tribunal that a major portion of the area of river basin, i.e. 1580 sq.km. (77.76%) lies in the State of Goa, 375 sq.km. (18.46%) area of the river basin falls in Karnataka and 77 sq.km. (3.78%) area falls in Maharashtra. In para 3 of his report,

the witness has mentioned about the availability of the data, whereas at page 20, which forms part of para 3(i), the witness has given Gauge and Discharge data of two existing G&D sites in

the basin, maintained by Central Water Commission. In para 3(ii), which is at page 21 of the report, the witness has provided the information relating to rainfall data. On reading the said para, it becomes evident that, the CWC (2003), after making an assessment has used the rainfall data, for the following rain-gauge stations in and around the Mahadayi basin, collected/supplied by IMD, for the respective periods, as shown in Table 2. The witness has mentioned that in his study, the rainfall stations used for the period 1964-1998, have been used for the extended period, i.e. 1999-2012. The Table No.2 provided by the witness at page 22 of his report is as under:-

Table 2: Data Availability of Rainfall in Mahadayi Basin

Period	Rainfall Stations
1928-40	Valpoi, Ponda, Panjim, Mapuca, Collem, Khanpur.
1941-63	Valpoi, Ponda, Panjim, Mapuca, Sanguem, Khanpur. Supa
1964-1998	Valpoi, Ponda, Panjim, Mapuca, Sanguem, Khanapur, Kankumbi, Castlerock, Jamagaon, Amagaon

145.

In para 4 of his report, the witness has mentioned

about the prevalent Methodologies for yield assessment of

catchment of river basins in India and has claimed that in the present scenario the method used by the Central Water Commission in its study of 2001 and 2003, has been relied upon since this is an accepted method. What is mentioned by the witness is that the Central Water Commission has used the rainfall-runoff relationship, for working out the long term series of the Mahadayi River Basin and in the present exercise, since the data of the additional 15 years has become available, it has been used to strengthen the CWC studies of 2001 and 2003.

146.

In para 5 of his report at page 23, the witness has stated about the consistency of flow and rainfall data, whereas in para 5.1 the witness has explained the stream flow data in detail. According to the witness at the Ganjim site, the observations are being carried out, using current meter with the help of boat and cableway during monsoon at higher stages and by wading during the non-monsoon at lower stages. The witness has further mentioned that during 2005-2006, a vented weir, 2 meter high, with a provision for vertical gates up to 4.5 meters high, was

constructed at about 1 km. downstream of CWC site at Ganjim, to facilitate pumping for drinking purpose to Goa and got into operation from March 2006 onwards. The witness has informed

the Tribunal that from November 2006 onwards, due to closure of the weir the discharge could not be observed during non-monsoon period as the flow velocities die down due to stagnation of water at the site. What is asserted is, that the contribution of this non-monsoon flow at the Ganjim site from December to May is insignificant, i.e. less than 3% of the annual flow and that, besides velocity, the other important factor in the discharge computation is the river cross-section at the site. The witness has stated that as a standard practice in CWC, pre-monsoon and post-monsoon cross-sections are taken every year and the Gauge and Discharge curves are updated accordingly from time to time, and since many of the times, flow data is measured directly by measuring the velocity in multiple segments, across the river cross-sections, G&D curves are used for observations made during the intervening days. The witness has pointed out that the two most common methods of discharge measurement practised by CWC are Current meter and Float methods and as per the standard practice of CWC, the data collected by both the methods is accepted by CWC for water

availability studies. In para 5.1.1 the witness has mentioned about the Internal Consistency of Flow Data as well as Ganjim Flow Series – Mass Curve Analysis and has mentioned that unlike

with rainfall data, where the double mass curve is used for consistency check, in case of flow data single mass curve analysis is generally carried out. In para 5.1.1.2, which is at page 26 of his report, the witness has mentioned about T-test for testing Homogeneity of the Ganjim series and has stated that mass curve analysis and t-test analysis of Ganjim series establish that the flow data is consistent over the years.

147.

In paragraph 5.1.1.3, which is at page 27 of his report, the witness has informed the Tribunal about Collem Flow Series and Mass Curve Analysis and has stated that, no appreciable kink is visible in the mass curve for Collem flow and data appears to be consistent. At para 5.1.1.4, which is at page 28 of the report, the witness has stated about the Homogeneity Test for the Collem Flow Series and has mentioned that the tests show a mixed reponse to the consistency check of the flow series of Collem, and therefore, the station has not been used further for detailed assessment of the basin water yield. Again in para 5.1.2, which is at page 29 of his report, the witness has considered the

External Consistency of Flow Series and stated that there is a dip in the flow data of both the sites, between the period 2000-2004, which establishes that in case of Ganjim, change in method of

measurement from float to current meter in 2001 has not resulted in any kind of systematic error in the data. The witness in para 5.2 of his report, which is at page 30 of his report, has referred about consistency of rainfall data and has stated that the processed monsoon rainfall data for the period from 1928-29 to 2000-01 and for the period from 2001-02 to 2012-13 are given at Appendix IV and V of the report.

148.

In para 6 of his report, the witness has mentioned about earlier studies for yield assessment of Mahadayi basin, made by (a) Preliminary Water Balance Study of National Water Development Agency;

(b) Draft report on Yield Studies for Mahadayi basin by Central Water Commission – September 2001.

While considering the above mentioned draft reports, the witness has mentioned that the length of the series to be used for building the Rainfall-Runoff relationship is an important factor and it is equally important to make appropriate selection of rain-gauge stations that should be used to get the mean average

rainfall for the respective catchment and (c) Report of March 2003 by the Central Water Commission on the Yield Studies of Mahadayi basin. In para 6.3.1 of his report, at page 34, the witness has mentioned about Runoff (Discharge) data, whereas

710

in para 6.3.2 the witness has discussed the rainfall data and in para 6.3.3.1 of his report, at page 35, the witness has mentioned about Weighted Catchment Rainfall of Ganjim, wherein Thiessen weights obtained are mentioned in Table 6, which is at page 35. In para 6.3.3.2 at page 35 of his Affidavit, the witness has dealt with the Weighted Catchment Monsoon Rainfall of entire Mahadayi basin and has stated that Thiessen weights have been worked out for different periods for those stations as indicated in Table 7. The witness has emphasized that considering the geographical locations of the rain-gauge stations vis-a-vis catchment and availability of data, Valpoi, Amagaon, Jamagaon, Castlerock, Kankumbi, Mapuca and Panjim are, the key Stations for the computation of the basin rainfall. At page 37, in para 6.3.3.3 of his Affidavit, the witness has mentioned about Rainfall-Runoff Model, whereas in para 6.3.3.4, the witness has stated about Generation of Water Yield series for the Mahadayi Basin and in para 6.3.4 the methodology adopted by CWC has been discussed by the witness.

149.

The gross annual yield series from 1928-29 to 2012-
13 for Mahadayi has been mentioned by the witness in para 7, at page 38 of his report. The weighted catchment monsoon rainfall

of Ganjim is mentioned in Table 8, which forms part of para 7.3.1 at page 40 of his report, whereas the weighted monsoon rainfall for the entire Mahadayi basin is mentioned by the witness in Table 9, which is a part of para 7.3.2 at page 41 of his report. In para 7.4 at page 41, of his report, the witness has discussed the generation of the Annual Yield series for the Mahadayi basin. Under the heading, 'Case - I', Extended Gross Annual Yield Series of Mahadayi basin for the period from 1998-99 to 2012-13 based on CWC Methodology and Regression Equation used in CWC's Report of March 2003, are mentioned, whereas under the heading, 'Case - II', Extended Gross Annual Yield Series of Mahadayi basin for the period from 1928-29 to 2012-13 based on CWC Methodology and Revised Regression Equation based on Extended Runoff data of Ganjim, measured by CWC for the period 1979-2012 are given. What is mentioned in para 7.5 at page 44 of the report, is the Gross Annual Yield up to Ganjim Site and of the Karnataka Catchment, whereas in para 7.5.1 the Annual Gross Yield at Ganjim is mentioned, and the Dependable Gross Yield at Ganjim is mentioned at Table 10, which forms part

of the said para. Again in para 7.5.2 at page 46 of his report, the witness has mentioned about the Annual Gross Yield in the Karnataka catchment and conclusions have been derived in para

8 of his report. At page 49 of his report, the witness has reproduced Annual Gross Yield in Mahadayi, Ganjim and Karnataka part of the Basin, in Table 11, which is already reproduced under Para 143 of this Report.

150.

This witness has further filed an additional Affidavit of Examination-in-Chief on 15 th November, 2016 (Volume 193). In the additional Affidavit, the witness has mentioned that, pursuant to the order dated 1.9.2016, passed by the Tribunal, he has filed, the additional Affidavit. This witness, with the additional Affidavit, has produced the copy of the supplementary study ('Supplementary study for yield assessment at project sites') along with enclosure as Annexure A to his Affidavit. The witness has mentioned that, a simple approach of using the proportional area method, with the rainfall factor of nearest observed rainfall, to the mean gauged sub-basin rainfall, has been used. The witness has categorically stated that, the yield at Bhandura dam is estimated by him as 3.7 tmc at 75% dependability, whereas the yield is estimated as 4.0 tmc at 75%

dependability in the detailed project report of 2000 (Volume 20). It is further stated that if the yield is 4.0 tmc, the project will operate at 70% dependability.

713

151.

Assessment

A glance at the Supplementary Study for Yield

at

Project

Sites,

enclosed

along

with

the

Supplementary Affidavit, makes it evident that, the yield available for power generation at Kotni Dam site is augmented by the diversion of Bail Nadi and Irti streams which join Mahadayi river down stream of Kotni dam site. It further shows that, the witness has computed the monsoon yield on the basis of catchment area – rainfall proportion applied to monsoon gauged flow at Ganjim Gauge Station. In para 1.3 of his supplementary study, the witness has mentioned areas of different catchment and he has stated that weighted rainfall in the catchment of

Ganjim site is taken from his Affidavit dated 15.9.2015. The witness proceeds to state that the rainfall of Chapoli and Gavali stations, available in the near vicinity of Kotni dam catchment and Bhandura catchment, are taken from the document Volume 98, whereas the monsoon rainfall at Ganjim has been taken from his Affidavit dated 15.9.2015.

152.

The topic of diversion to Kali River Basin is discussed by the witness in para 2 of his Affidavit and the Kalasa Diversion Scheme is discussed by the witness in para 3 of his Affidavit. The

714

Irti Pick up Dam, downstream of Kotni Dam, with independent catchment, is considered by the witness in para 4 of his Affidavit. The witness has mentioned that the rainfall of Chapoli and Gavali stations, as available in the near vicinity of Irti pick up dam, catchment, is taken from document Volume 98.

153.

In his supplementary study, the witness has asserted the combined flow at Kotni dam site at 50% and 75% dependability, is 23.9 tmc and 19.4 tmc, respectively, whereas the combined flow for diversion at Kali Basin at 50% and 75% dependability, is estimated by the witness to be 6.1 tmc and 5.3 tmc, respectively. The witness has further asserted that, the combined flow available at Kalasa Nala catchment including the diversion of Haltara and Surla at 50% and 75% dependability is 4.6 tmc and 3.8 tmc, respectively, whereas the flow available at Irti dam catchment, at 50% and 75% dependability is, 1.5 tmc and 1.2 tmc, respectively.

154.

The witness has filed an Affidavit dated 24.3.2017

(Volume 197), wherein he has referred to the fact of his filing his Affidavit before the Tribunal on 12.9.2015. According to the witness, on 22.3.2017, the learned Counsel for the State of

715

Karnataka had made a statement that due to oversight, his Affidavit sworn on 12.9.2015 had not been “properly affirmed and verified” and had sought permission of the Tribunal to file a properly affirmed and verified Affidavit. Thus by filing the Affidavit, the witness has reiterated the contents of his Affidavit sworn on 12.9.2015, and Annexure A and B thereto, and has verified, the contents of paras 1 to 3, including Annexure A of the Affidavit sworn on 12.9.2015.

155.

This witness has further filed an Affidavit dated 11.5.2017 (Volume 198) in support of the analysis of yield of Mahadayi basin, taking rainfall data from 1928-29 to 2012-13. After referring to the fact that he had sworn and filed the verified Affidavit on 24.3.2017, by annexing the Report authored by him and Shri A.K. Goyal in September 2015 as Annexure B, the witness has stated that, in response to question Nos.98-99, put by the learned Counsel for the State of Goa, he had offered to conduct the analysis by using rainfall data mentioned therein. The witness has claimed that, accordingly, he had prepared the

analysis titled as ‘Analysis of Yield of Mahadayi Basin taking Rainfall Data from 1928-29 to 2012- 13’, which was finalized by him, on 9th May, 2017. The said analysis has been appended as

Annexure A (Colly.) to his Affidavit. The witness has stated that the contents of Annexure A (Colly.) to his Affidavit, are based on his expertise in the field of Water Resources Engineering and that the analysis produced by him provides further credence to his study mentioned in the Report, prepared in September 2015, which was filed as Annexure B to the Affidavit sworn on 24th March, 2017.

Again paras 1 and 2 of his Analysis at Annexure A, describe Mahadayi basin. In para 3 of the Analysis, the witness has mentioned about the Gross Annual Yield Series from 1928-29 to 2012-13. In para 3.1 of his Analysis, the Runoff Data is considered, whereas in para 3.2 the Rainfall Data is considered, and in para 3.3 the Methodology adopted for working out the Long Term Annual Yield Series for Mahadayi basin is described. The estimation of Weighted Monsoon Catchment Rainfall is mentioned, in para 3.3.1 at page 4 of the Analysis, and the Weighted Catchment Monsoon Rainfall of Ganjim is mentioned, in para 3.3.1.1 at page 4 of the Analysis. The Thiessen Weights for Ganjim Site (CWC Report 2003) is re-produced at Table 1 on page

5 of the Analysis, whereas in para 3.3.1.2, the Weighted Catchment Monsoon Rainfall of entire Mahadayi basin, is

reproduced in Table 2. The witness has pointed out that, the weighted catchment monsoon rainfall, for the Mahadayi basin, for the period from 1928-29 to 2012-13 is appended at Annexure VI to his Analysis. In para 3.4 of his Analysis, the witness has referred to, Rainfall – Runoff Model and Generation of the Annual Yield series for the Mahadayi basin, and in para 3.4.1 the witness has described, the Extended Gross Annual Yield Series of Mahadayi basin for the period from 1928-29 to 2012-13, based on CWC Methodology and Revised Regression Equation, based on Runoff data of Ganjim, measured by CWC during the year 1979-2012. The witness has further mentioned the revised R-R relationship and has stated that the value of R works out to about 0.816, which is considered to be good.

156.

Under the heading, ‘Case - I’, mentioned in para 3.4.2 of the Analysis, the witness has stated that the monsoon yield series have been obtained, by substituting the catchment rainfall in mm for the monsoon, for the period from 1928-29 to 2000-01 in the best fit R-R relation. The witness has further proceeded to

state that the 50% and 75% dependable annual gross yield, for the entire Mahadayi basin, adopting this approach, works out to 6105 Mcum (215.59 tmc) and 5619 Mcum (198.42 tmc),

respectively. The Mahadayi gross annual yield series, thus worked out, has been appended at Annexure VIII to the Analysis.

157.

Under the heading, ‘Case - II’, mentioned in par a 3.4.3, on page 7 of the Analysis, the witness has mentioned that the monsoon yield series, have been obtained by substituting the catchment rainfall in mm for the monsoon period from 1928-29 to 2012-13 in the best fit R-R relation and the 50% and 75% dependable annual gross yield for the entire Mahadayi basin, from this approach, works out to 6141 Mcum (216.89 tmc) and 5736 Mcum (202.55 tmc), respectively. The Mahadayi gross annual yield series, thus worked out, is appended at Annexure IX to his Analysis. In para 4 of his Analysis, the witness has mentioned, details of Gross Annual Yield up to Ganjim site, and in the Karnataka catchment. This is found in Table 3 on page 8. As mentioned in para 4.1 on page 9 of his Analysis, the Karnataka catchment of Mahadayi basin is 375 sq. km. against the Ganjim catchment of 880 sq.km., and 50% and 75% dependable gross annual for the Karnataka catchment, by area proportion method,

works out to 1460.35 Mcum (51.57 tmc) and 1223.26 Mcum (43.57 tmc) respectively.

719

158.

The conclusions have been arrived at by the witness in para 5 of his Analysis, which are to be found on page 9 of the Analysis and they are in Table No. 4 which read as under:-

Table 4: Annual Gross Yield in Mahadayi Basin by Different Approaches

Dependa-bility	Annual Gross Yield for entire Mahadayi Basin (1928-29 to 2000-01) Using Revised Regre-ssion Equation	Annual Gross Yield for entire Mahadayi Basin (1928-29 to 2012-13) Using Revised Regre-ssion Equation	Annual Gross Yield for entire Mahadayi Basin (1928-29 to 1997-98) As per CWC Report 2003	Annual Gross Yield at Ganjim (1979-80 to 2012-13)	Annual Gross Yield at Goa/ Karna-taka Border based on catchme nt area propor-tion w.r.t. Ganjim (1979-80 to 2012-13)
50% (Mcum)	6105	6141	6234	3427	1460

75% (Mcum)	5619	5736	5652	2871	1223
50% (tmc)	215.59	216.89	220.13	121.02	51.57
75% (tmc)	198.42	202.55	199.58	101.37	43.20

159.

After reproducing the Annual Gross Yield in Mahadayi

Basin, by different approaches in Table No.4, the witness has

stated that the 50% and 75% dependable annual gross yield, of Mahadayi basin worked out by different approaches, is very near to each other, and therefore, the witness has recommended to use the 50% and 75% dependable gross annual yield for Mahadayi Basin as 6141 Mcum (216.89 tmc) and 57.36 Mcum (202.55 tmc).

160.

The witness was cross-examined by the learned counsel for the State of Goa at length and in great detail. Further to elicit the best information relating to availability of water, the Tribunal had also put certain questions to the witness. Under the circumstances, the Tribunal proposes to deal with, only those questions and answers, which are found to be relevant.

161.

The learned Cross Examiner for the State of Goa wanted to know from the witness as to whether the Science of Hydrology, and particularly the computations like yield study, design flood study, etc. require the Hydrologist to make a judgment based on his experience, or is it an exact science,

where given the same data set, all Hydrologists could reach the same conclusions.

721

The answer given by the witness was that the judgment of the Hydrologist is very important in terms of assessing, what are the conditions which are prevailing including the data availability in making a judgment as to which procedure or method is most appropriate under the circumstances. The witness has further stated that the Hydrology is not an exact science mainly on account of the high complexity of the nature and very high variability of the influencing characteristics as well as weather conditions. The witness has further clarified that, given the same data and having defined the procedure to be used, different Hydrologists should come out with the same answer.

At that stage, the attention of the witness was drawn to what is stated by him in para 5 on page 5 of his Affidavit dated 12.9.2015, where the witness has stated that “He independently cross checked the various aspects on which he had sought for and had received technical computation from Mr. Goyal”. A fter drawing his attention to above mentioned statement, a question was put to the witness as to whether he had accepted the technical computation, which he had received from Shri Goyal, at

the face of it or had he differed with him on occasions, by carrying out his own corrections. The witness has categorically

replied that he had not taken the computation given by Shri Goyal, on the face value and he had, at times, observed some of the things and had informed Shri Goyal for corrections, but it is not so stated in his report, nor had it been so mentioned in his Affidavit.

162.

The learned Cross Examiner wanted to know from the witness as to what are the main differences, if any, between his yield study and CWC study of 2003. In answer thereto, the witness has mentioned that there is no difference between the procedure adopted by CWC study of 2003, and even study of 2001, and his study. The witness has stated that, in Hydrology, when one uses the method of co-relation, it is always preferable, to use as long a length of observed flow data, as possible and it is also preferable that the length and data should be at least of 30 years. Responding to the question, as to why length of such data should be at least 30 years, the witness has stated that the nature will exhibit all the variability in terms of good monsoon years, bad monsoon years and average monsoon years, with the

result, the correlation functions data derived at, shall be more appropriate, for any extension of flow series, using the long-term rainfall data. According to the witness, this is the reason that,

when he looked at CWC (2003) Report it was found by him that, the data used was till around 2001, and at least another 15 years of flow data had become available, and it was advisable to update that study, to have a more reliable outcome, on the yields of the basin. The learned counsel for the State of Goa drew the attention of the witness to the answer given by him to question No.66 wherein the witness was specifically asked that the CWC report does not anywhere, state that the study had been examined, and approved by the CWC and since the witness had not chosen to answer this part of the question, whether the witness would wish to say, as regards that part of the question No. 66, which had remained unanswered. In answer to this question, the witness categorically mentioned that he could not find the word “approved” in the Report of CWC (2003). The witness further stated that as far as examination is concerned, the Committee has all along been examining the Report, and therefore, the term “examined” used in the question, is irrelevant. The witness further claimed that he had never seen in any study being mentioned, that the study is approved, and

proceeded to state that he has no knowledge of what was the fate of the Report, and whether it was placed before the CWC authorities or not.

The witness was asked as to whether he was able to state very categorically that the document titled “Reporting State of Karnataka’s Compliance of the Order dated 30.9.2014” (Volume 98), filed by the State of Karnataka before this Tribunal on 1.12.2014, was in compliance to the Order dated 03.09.2014 passed by the Tribunal, and whether that document was ever seen by him, while undertaking, carrying out, or before completion of his study. The categorical answer given by the witness to this question was that this document (Volume 98), as a whole, was not shared with him, by the State of Karnataka, and some pages thereof, where his name had appeared, were handed over to him. The learned Cross Examiner for the State of Goa wanted to know from the witness that, when rainfall data is available at many stations, in and close to a catchment, he should explain as to how the decision is taken, to either use or not to use the data of each Station, and also to explain as to what criteria or tests are applied, to select the Stations, whose data is to be used. The response given by the witness was that this is where the judgment of a Hydrologist comes into picture and it is very

difficult to make generic rules, to cover all circumstances,

because there are many issues, which will have to be looked into,

while making such decisions, so as to select a specific Rain Gauge Station, for a specific area. The witness gave an example and stated that if there is a station very close to the boundary of a basin, but is lying on a leeward side, it will not be a good representative Station, to be taken for that basin, whereas in other situations, a rain gauge station might be considered, even if it is not falling within the basin, but is the only one available in the near vicinity.

The witness has asserted that as he had mentioned earlier, the quality of data and length of data etc., can play a role in the selection of a Station.

The learned Cross Examiner wanted to know from the witness as to whether while selecting the rainfall Station, whose data he had used, was the Station being an IMD or non-IMD, a criterion and was there any occasion for him to reject data of any Station, because it was a non-IMD Station. The answer given by the witness was that he would first give the priority to an IMD Station, but if a situation arises, where a non-IMD Station is the only data available, then he would consider that data also, with

due verifications. The witness informed the Tribunal that he was not remembering any specific instance, where he had rejected a Station only because it was a non-IMD Station, and has stated

that a non-IMD Station would have been ruled out for consideration, if adequate number of IMD Stations, were available, for those respective studies. The learned Cross Examiner for the State of Goa put to the witness that the difference between conducting an yield study of a river which ends as a tributary of another river, vis-à-vis a river which outfalls into the ocean/sea, is that as the river nears the coast, the land becomes flat and a part of the catchment may drain directly into the ocean/sea, and therefore, the water resource accruing from the rainfall from this area cannot be put to beneficial use, and therefore, this area should be excluded from the computation of yield study. In answer to this suggestion, the witness stated that he would not agree to this suggestion. The witness further stated that if any area is directly contributing to the sea, then while delineating the area of the basin, such area shall not become part of the basin and as far as some part of the riverine system becoming affected by the tides and storm surges, it is a part of the natural performance of the system and is playing many important roles which one keeps on aspiring for, and therefore, it

is not meaningful to take off that part of the basin for the yield computation.

It was put to the witness that when a yield study is conducted for a basin, which is an inter-State basin, then, since water resource, if at all, are to be allocated, amongst the party States, it would be necessary to compute the yield from only that catchment area, from where the water resource can be captured, and put to beneficial use. In answer, the witness did not agree with the suggestion and proceeded to state that one cannot imply that the water, which is being used by the human beings, is the only beneficial use and even if it is assumed that, any such portion, which the State wants to exclude, on account of any given reason, shall also change the proportion of the yield of the State, within the remaining basin, and therefore, any way one looks at, the proportion of the State, out of the total yield, should remain the same.

It was brought to the notice of the witness that he had derived the Runoff Equation as: Runoff = 0.7368*Rainfall + 432.28, but on verification of the table containing weighted rainfall at Ganjim, and also the observed runoff at Ganjim in mm for the years 1979 to 2012, extracted from his Report, the State

of Goa was unable to get the same equation and that the State of Goa got the equation as: Runoff = 0.4802*Rainfall + 1751.737,

and therefore, the learned Cross Examiner wanted to know from the witness as to how he had got the regression equation: Runoff = 0.7368*Rainfall + 432.28.The answer given by the witness was that while deriving the regression equation, it is always important to understand the other conditions also and he further stated that he was told that the State of Goa had achieved the equation as: Runoff = 0.625*Rainfall + 1278.113.

The witness further stated that he had used this equation to derive the Mahadayi yield, as per the procedure and data used in CWC (2003) Report and he had got the yield of 238.69 tmc at 50% dependability, which is drastically different from the yield obtained by CWC (2003) Report. The witness mentioned that he believed that the State of Goa had ignored a very important line provided in CWC (2003) Report at pages 9-10, to the effect that “Regression analysis has been carried out using the monsoon catchment rainfall and concurrent runoff and best fit R-R relation obtained, ignoring inconsistent data of monsoon rainfall/runoff points as per standard practice” and thereafte r,

the witness

proceeded to state that if the Govt. of Goa had not used the proper information while deriving the R-R relation, then the Govt. of Goa was bound to get a different equation, but as far as the

above referred equation is concerned, it is derived by ignoring all the years, with the runoff factor of more than 1.0.

The learned counsel for the State of Goa put to the witness that the intercept indicated in question No.190 was positive, which means, even if the rainfall was zero, there would be some runoff and for a catchment area of 2032 sq.km., for zero rainfall, his equation had given the runoff as 31.02 tmc, which was not proper. In answer to the said suggestion, the witness stated that the regression equation relationship, is derived using the range of observed rainfall and observed runoff and it is assumed that the relationship is linear, which may be an approximation in itself and these relationships are not supposed to be extrapolated, beyond the normal ranges of these two entities, and therefore, relationship would not be valid, if one extrapolates to the level of zero rainfall.

163.

The attention of the witness was drawn to the answer given by him in question No.193, wherein it was stated by the witness as under:-

“It is correct, t he way it is put. But at the same time, as

I have explained earlier, that the validity of this

regression equation has to be within the range of the values which have been used while deriving the equation. If you refer to my September, 2015 Report at pages 68-69, Appendix-VIII, you will not find even a single value for all the years beginning from 1928 to 1997 where the yield has been more than the rainfall by using the same equation. "(Underlining supplied by me).

The witness was asked as to whether still he stood by the underlined portion of his statement and the answer given by the witness was that he was standing by the underlined portion of his statement.

The attention of the witness was drawn to Appendix XII of his Report dated 12th September, 2015, more particularly, at pages 76 and 77 thereto. The witness was asked to look to the year 1971 where the rainfall was 1331 mm, and the runoff was 1413 mm and it was pointed out to the witness that the runoff was more than the rainfall, which was completely contrary to his assertion made by him in answers to questions No. 193 as well as

201, wherein he had categorically stated that not even in a single year, the runoff had exceeded the rainfall. After bringing the above facts to the notice of the witness, the learned Cross

731

Examiner for the State of Goa wanted to have the response of the witness.

In response, the witness stated that his answer to question No.193 must be looked into its proper perspective and the witness reproduced the relevant portion of the answer given by him to question No.193, which is as under:-

"…that the validity of this regression equation has to be within the range of the values which have been used while deriving the equation .If you refer to my September, 2015 Report at pages 68-69, Appendix-VIII, you will not find even a single value for all the years beginning from 1928 to 1997 where the yield has been more than the rainfall by using the same equation. (Underlining supplied by me to emphasize.)"

164.

The witness stressed that in the above explanation, it is very categorically mentioned that the range of values used, while deriving the R-R relationship, is an important aspect of the equation and that one would find that, the equation remains

true, to the aspect of not having any single value, as is indicated in Appendix VIII of his Report of September, 2015, which pertains to the range of values which are quite similar to the ones used while deriving the R-R relationship. The witness proceeded to

state that there can be one odd value, which in Hydrological terms is termed as “Outlier”, which is out of range, and that is why it has emerged and the main question is that how much impact it has on the final outcome.

165.

A question was put to the witness to the effect that actually, and factually, the data used for his study of September, 2015, and that used for the study in May, 2017, were different and distinct and that if the witness had not changed it purposely, then how the different and distinct data were found. In answer to the said question, the witness mentioned that his September, 2015 Report is extension of the CWC (2003) Report, and the processed data of CWC (2003) Report is taken for working of that Report. The witness mentioned that this is also apparent from Annex. II, page 13 of May, 2017 Report, and Table 10, Page 45 of his September, 2015 Report, from which, it can be observed that the observed monsoon runoff for Ganjim is exactly the same from the year 1998 to the year 2012, and

that, the minor

differences, between the two Reports, are because of the reason that in one (Report of September, 2015), the data has been taken as such for the period from 1979 to 1997, and in the Report of

733

May, 2017, the data has been processed, using the detailed daily data.

166.

A question was put to the witness that in his opinion what should be the value of regression equation factor to be used at Ganjim site, for Mandovi river, and the answer given by the witness is that usual value of regression equation applied is in the near vicinity of 0.85, but the exact value used at Ganjim site should be known to the CWC.

167.

The witness has stated in paragraph 6.3.2 of his report at page 34 that the rainfall data of some whole years/some months in a particular year are found missing for some of the Stations and the same is filled by using the standard method of Normals, and therefore, a question was put to the witness as to what is the basis on which the witness has made the said statement. In answer thereto the witness mentioned that in filling of rainfall data, using the method of Normals is a standard procedure in Hydrology for filling of the missing rainfall data.

168.

The attention of the witness was drawn to Appendix

IV at page 61 of his Report, wherein in 34th column, data of

Mapuca for the year 1961 was mentioned and the rainfall indicated was 2874 mm. It was pointed out to the witness that this continued for the years 1962, 1963, 1970, 1971, 1972, 1976, 1977, 1978, 1979, 1980, 1988, 1989 and 1998, whereas in the case of Sanguem in the same Appendix IV at page 61 the rainfall was stated to be 3638 mm for 10 years i.e. for the years 1961, 1962, 1963, 1967, 1972, 1974, 1977, 1978, 1980 and 1998 and in case of Valpoi the rainfall was shown as 3934 for the 9 years, namely 1972, 1976, 1977, 1978, 1980, 1988, 1992, 1993, 1994 and 1995. The witness was asked to explain why the data of Mapuca, Sanguem and Valpoi were exactly the same as the last mm for the aforesaid several years. The answer given by the witness was that he was not the right person to tell why the values were the same for many years, because he was not a party to the process of processing the data.

169.

After referring to the errors pointed out to the witness in question No.86, the attention of the witness was invited to pages 19 and 33 of Volume 15, wherein in the Table at page 29,

unprocessed data and in the Table at page 33, the processed data, were mentioned, which made it clear that not only the missing data have been filled, but the data that was not missing

was also modified, which is apparent from the data relating to the year 1978. It was also brought to the notice of the witness that the observed data at page 29 was 2884.6 mm and the processed data at page 33 was 4905 mm, which was, thus increased by as much as by 70%, and similarly the data for 1979 for the same station has been increased by 37%; for 1981 by 67%; and for 1989 by 52%, and therefore, the witness was called upon to explain by which method known to the science of Hydrology were these increases made.

170.

Again in answer to the said question, the witness stated that he was not party to the process. He also mentioned that it was very difficult for him to say as to what was the real reason of the difference and he believed that all these valid questions must have been resolved by the learned and experienced water resources personnel of the three participating States, and by the lead i.e. CWC at the appropriate time. At this stage a question was put to the witness as to whether he had compared the data given on two pages, i.e. on page 29 and page

33 of CWC Report (2003) (Volume 15), before undertaking his study and whether did he find any improvement in Appendix VI at page 33 over the data given at Appendix V at page 29 of the

said report. The response of the witness was that he had not checked each station with respect to the data, which was the outcome of processing for that station, as he was not having the complete information of what steps of processing had gone in between the figures appearing in Appendix V and Appendix VI. The witness mentioned that when the raw data were not made available, he had adopted the other option of using the processed data after due verification through the consistency check.

171.

The question was put to the witness that whether while preparing three different Reports within a span of less than 20 months, namely his Report dated 12th September, 2015, his another report dated 15 th November, 2016 and his still another report dated 11 th May, 2017, whether he had considered taking into account the factors – reliable yield of the State of Goa on the water coming from the upstream of Mahadayi region, presence of thick and thin Stations, the fact that the river passes through Mhadei Wildlife Sanctuary, Bhagwan Mahabir Wildlife

Sanctuary, Mallew National Park, Dr. Salim Ali Bird Sanctuary, requirement of maintaining the level of water in river Madei for navigation purposes and highly pristine eco-sanctuaries of the

coastal eco-system. The answer given by the witness was that he had not taken into consideration those factors and all the factors mentioned in the question were not required to be considered while finding out the yield of the basin.

It was brought to the notice of the witness by the learned Cross Examiner for the State of Goa that the State of Karnataka has not done any yield study of its own, whereas in his Report dated 12 th September 2015, the witness has extended the series prepared by CWC in the so called 2003 Report. It was also brought to the notice of the witness that the CWC had worked out the yield of Mahadayi basin at 75% dependability as 1958 tmc, whereas in his study dated 12th September, 2015 the witness had worked out the yield of Mahadayi basin at 50% dependability as 204.24 tmc and 206.14 tmc, whereas in his study dated 11 th May, 2017, the witness has worked out the yield of Mahadayi basin at 75% dependability as 198.42 tmc and 202.55 tmc.

172.

It was also brought to the notice of the witness that

when he had prepared the second and third Report dated 15 th November, 2016 and 11 th May, 2017, respectively, for computing

the yield at the project locations at different places of Karantaka and for giving so called credence to his Report dated 12 th September, 2015, he was a Member of the NGT Committee, which had been appointed under the auspices of MOEFCC to determine, the carrying capacity of Western Ghat. The question was put to the witness as to whether being a Member of the aforesaid Committee, had he considered the provisions of Wildlife (Protection) Act, 1972 and more particularly section 29, which prohibits any person to interfere with the water coming into the sanctuary or otherwise diverting or by any act, whatsoever diverting, subjecting or enhancing the flow of water of the sanctuary. The answer given by the witness was that for the yield assessment periods, these factors were not required to be considered.

After drawing the attention of the witness to the answers given by him to question Nos.57, 60, 65 and 96 that the CWC is an apex organization of the country, it was put to him that he dreaded to think of the situation when on the data being collected by the apex organization, if a challenge was thrown to

it, it would give rise to inter-State dispute about water, which would not be good for the society and the witness was called

739

upon to explain as to why, while making report of November 2015 for determining the yield at 8 locations in the State of Karnataka, he had not followed the methods indicated and used by CWC for computing the yield on the project sites. The answer given was that he had used the method which was most appropriate with respect to the data availability.

173.

After the cross-examination of the witness by the State of Goa was over, the learned counsel for the State of Maharashtra was called upon to cross-examine the witness, but the learned counsel Shri D.M. Nargolkar representing the State of Maharashtra had stated that he had no question to ask to this witness by way of cross-examination. Thereafter, the witness was put several questions by the Tribunal but it is proposed to refer to only the relevant questions put to the witness by the Tribunal.

174.

It para 5.1.1.3 on page 27, relating to Collem Flow Series – Mass Curve Analysis of his Report of September 2015, it is stated by the witness that there was some falling trend

observed in the later part of the series, whereas from Table 4: t-Test: Paired Two Sample for Means-Collem on page 28, it is noted that the mean of first 16 years of data was about 25% higher than

the mean of the later 16 years of data. Therefore, the Tribunal wanted to know as to what could be possible reasons for such falling trend and why such reasons should not be taken into consideration, while assessing the water availability for the Mahadayi catchment as a whole. The answer given by the witness was that it is very difficult to assign specific reasons for such behavior, without thorough examination of all the data, pertaining to the basin, and one possible reason could be less rainfall in those years. According to him, in the present case because of another gauged basin namely Ganjim, which is much bigger in size, being available having consistent data, there was no requirement of exploring this small basin further.

175.

It was noticed by the Tribunal that pursuant to the average monsoon rainfall for the catchment area of Mahadayi upto Ganjim, as assessed by the Expert Witness of the State of Goa, and that, by the witness indicated considerable variations. It was found that the mean of the average monsoon rainfall estimated by the Expert Witness of the State of Goa during the

period from 1979 to 2005 was 4685.5 mm, whereas, on the other hand, the mean of the average monsoon rainfall estimated by this witness for the same period was only 4072.2 mm and thus

741

the mean of the average monsoon rainfall estimated by Expert Witness of the State of Goa was about 15% more, than the mean of the average monsoon rainfall, estimated by this witness. It was also noticed that for the year 1998, the average monsoon rainfall assessed by the Expert Witness of Goa was about 59% more than that assessed by this witness. Therefore, the Tribunal wanted to know from the witness as to whether such considerable variations are possible only due to selection of different groups of rain gauge Stations by two Experts and what could be other possible reasons for such variations. In answer, the witness stated that one possible reason, as mentioned, could be the selection of rain gauge Stations, but the selection of Stations could not have made huge differences.

The witness further proceeded to state that the other possible reason for such variation could be application versus non-application of prescribed consistency checks, as part of the data processing.

176.

It was noticed by the Tribunal that in his Report titled

“Analysis to Check the Consistency of Rainfall Data in and around Mahadayi River Basin”, [Annexure A of “Further Response of the State of Karnataka to the Brief Note handed over to the Hon’ble Tribunal at the Hearing on 11.2.2015 (read with Orders dated

3.9.2014 and 12.2.2015)" filed by the State of Karnataka on 15.4.2015] (Volume 122), it is stated that recently a new product of India Meteorological Department, in the form of high resolution gridded daily rainfall data (0.25°x0.25° resolution), derived using quality controlled Station data (http://www.imd.gov.in/ doc/nccraindata.pdf) has come into being, which is supposed to be a much better product, which has been used here for consistency analysis. It was also stated that the location of these grid points in and around the Mahadayi basin have been shown in Figure 2, and therefore, under present situation, it is decided to use a recent product of India Meteorological Department, in the form of high resolution gridded daily rainfall data (0.25°x0.25° resolution), derived using quality controlled Station data, but, in the Report titled "The

Yield Study of Mahadayi Basin" submitted as Annexure -B of the Affidavit of the witness, he had not used the data contained in the new product of India Meteorological Department, in the form of high resolution gridded daily rainfall data which in his opinion was, much better product. Therefore, the witness was called upon to explain the reasons for not using a much better product. The witness was further asked also to tell, whether the high resolution gridded daily rainfall data included in the new product

of India Meteorological Department, which in his opinion is much better product, should be invariably used for development of rainfall runoff models and if not, the reasons therefor.

In answer to the said question, the witness stated that personally he felt that the gridded daily rain fall data as provided by the IMD was more suitable for the end users, since it was a processed rainfall data, checked for most of the possible errors, but in the present case, since it was a matter of difference of opinion between the parties, he did not want to bring in another parameter i.e. the authenticity of the gridded data itself, since he knew that it was an end product of interpolation of the available actually observed rainfall and transformed on a uniform grid of 0.25°x 0.25° by IMD, and having started in that direction and having submitted one Report of consistency of the gridded data, he had decided to use the actual rain-gauge Stations for his analysis.

177.

It was noticed by the Tribunal that the witness had carried out, the detailed analysis in respect of homogeneity and

consistency of flow data, observed at Ganjim and the results of the same have been presented at Para 5.1.1.1, Para 5.1.1.2 and

744

Para 5.1.2 at pages 26 to 30 of his September, 2015 Report. It was further noticed that the witness had asserted at page 39 that the “observed series at Ganjim had been found consistent”. Further it was noticed that while carrying out the analysis for development of linear regression equation, Central Water Commission had ignored, the data set of, as many as 9 years out of 19 years, and therefore, the Tribunal wanted to know from the witness that how can such data be considered as consistent and reliable. In answer to the said question the witness mentioned that by excluding these 9 years out of 19 years, for the process of formulating the R-R equation, does not imply that there is something wrong with the observed flow of these 9 years. The witness proceeded to state that those have been ignored by CWC as well as by him, as part of the stipulated process, to ensure that there is no unnecessary bias on account of such extreme events, in the R-R equation, since the equation is required to be used for extrapolation of runoff using the rainfall. What is important to notice is that the witness has admitted that this implicit explanation was not mentioned in CWC (2003)

Report as well as in his September, 2015 Report.

745

178.

In para 4 at page 3 of the additional Affidavit dated 15.11.2016 (Volume 193), the witness has mentioned that “the methods deployed by the respective departments to estimate the water yield have been variable since there is no unique approach that is universally used”. Therefore, the witness was called upon to name the various respective departments and the methods deployed by each of them, to estimate the water yield. In answer to the said question, the witness has mentioned that he did not have the record as to which Department had used which method of estimating water yield. The witness has proceeded to state that he was able to tell the methods employed by the various Departments ranging from empirical relationships, such as Inglis Formula, and Rational method to approaches such as Area Proportion method.

179.

In para 2.2, on page 8 of the additional Affidavit of November, 2016 (Volume 193), the witness has stated that “the monsoon measured yield at Collem G&D site and Ganjim G&D

site is adopted for the study". It was noticed by the Tribunal that from para 2.3 and para 2.4, on page 8 for the purpose of estimation of yield for the Katla-Palna diversion and Diggi diversion sites, the witness had used the gauged data of Collem

G&D site, whereas in Para 5.1.1.4, on page 29 of the Report dated 15.9.2015 (Volume 166) , he has concluded that “the tests show a mixed response to the consistency check of the flow series of Collem, therefore, the Station has not been used further for any detailed assessment of the basin water yield”. Under the circumstances, the witness was called upon to explain as to why the data of Collem G&D site was now used, although he had decided earlier not to use the same any further for assessment of basin water yield. The answer given by the witness was that the data of Collem G&D site was not rejected altogether, and only, it was not used for the extrapolation using the R-R method. The witness has emphasized that it is important to understand that in Hydrology, whatever has been recorded through observations, is the truth and it is not possible to go back in time, to re-observe it, and any segment of data that is available, must be re-looked at, for appropriateness of its use, after checking it from various angles, under different situations.

What is claimed by the

witness was that in any case, the Collem data only failed the t-

Test, which means that it had shown two parts of the flow time series, which were different in mean value and this could have happened, on many different accounts, such as the area getting low rainfall consistently for some years.

According to the

witness, the same Station of Collem passed the F-Test for variance, and therefore, the station was never discarded in true sense, because there was nothing grossly wrong found.

180.

It was found by the Tribunal that from Table under para 7, page 4 of the additional Affidavit dated 15.11.2016, the witness has estimated the yield at 10 sites for 50% dependability, 60% dependability, 70% dependability and 75% dependability, but in his Report of September, 2015, he has estimated the yield at 50% dependability and 75% dependability only. Therefore, a question was asked to the witness as to why has he estimated, the yield at the 10 sites for 60% dependability and 70% dependability in addition to 50% dependability and 75% dependability and what is the utility of estimated value of yield at 60% dependability and 70% dependability, for the 10 sites? The answer given by the witness was that while estimating the yields for various projects, the dependability computations were also made for other values beyond 50% and 75%, such as 60% and 70%, since the worked yields of these projects by the respective

organisations, were available, and he was trying to find out, by how much per cent of dependability, the various earlier computed yields by different Departments, would be different

from the present value. The witness gave the example that on page 4 of his November, 2016 Report, it is mentioned that “The yield at Bhandura dam is estimated by him as 3.7 tmc at 75% dependability, whereas the yield is estimated as 4.0 tmc at 75% dependability”, and therefore, the idea was to arrive at more clarity in the results.

181.

In para 8 at page Nos. 4 and 5 of the additional Affidavit of November, 2016, the witness has stated that the yield at Bhandura dam was estimated by him as 3.7 tmc at 75% dependability, whereas the yield was estimated as 4.0 tmc at 75% dependability, in the Detailed Project Report of 2000 (Volume 20), and if the yield was 4.0 tmc, the project would have operated at 70% dependability. Therefore, a question was put to the witness as to whether had he gone through the Detailed Project Report of 2000 (Volume 20) of the Bhandura dam and had critically examined the procedure for estimating the yield at 75% dependability. The answer given by the witness was that he had looked at the hydrology part of the Detailed Project Report

of 2000 (Volume 20), of the Bhandura Dam, but he was not remembering at the juncture, all the details regarding the procedure for estimating the yield at 75% dependablility.

749

Thereafter, a copy of the page 9 of the Detailed Project Report of Bhandura Water Diversion Scheme prepared in 2000 (Volume 20) was handed over to Prof. Gosain and he was asked to tell whether he agreed with the procedure adopted for estimation of 75% dependable yield and that whther the rainfall can be taken as yield. The witness stated that he did not agree with the procedure adopted in the DPR (Volume 20).

182.

With the objective to ascertain, the extent of variations in the data, of a rain-gauge Station in the Report of the witness of May 2017 (Volume 198) with respect to the data of same rain-gauge Station included in his Report of September 2015 (Volume 166), the rainfall data for the period from 1979 to 2012 was examined by the Tribunal and a Statement was prepared. The Table showing comparison of rainfall data in mm and percentages in Reports of the witness of 2015 and 2017 was prepared and the same was handed over to the witness and was taken on record and marked as MARK-26. It was found by the Tribunal that for Valpoi, the average value of monsoon rainfall

included in the Report of the witness of May 2017 (Volume 198) was about 2% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166) and in several years,

there were considerable variations ranging from 52% more to 28% less. For Ponda, it was found that the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 3% more than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166), but, in many years, there were considerable variations ranging from 70% more to 12% less. For Panjim, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 3% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166). It was noticed by the Tribunal that in few years, there were considerable variations ranging from 8% more to 43% less. For Mapuca, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 2% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166), and in few years, there were considerable variations, ranging from 12% more to 45% less. For Sanguem, the average value of monsoon rainfall included in the report of the witness of May 2017 (Volume 198)

was about 8% less than the average monsoon rainfall indicated in his report of September 2015 (Volume 166), whereas in several years, there were considerable variations ranging from 18% more

to 50% less. For Khanapur, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was found to be about 4% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166), whereas in several years, there were considerable variations ranging from 60% more to 33% less. For Kanakumbi, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 11% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166), but in many years, there were considerable variations ranging from 44% more to 44% less. For Jamagaon, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 3% less than the average monsoon rainfall indicated in his Report of September 2015 (Volume 166), but in many years, there were considerable variations ranging from 56% more to 42% less. For Amagaon, the average value of monsoon rainfall included in the Report of the witness of May 2017 (Volume 198) was about 37% more than the average monsoon rainfall indicated in his Report of September

2015 (Volume 166), whereas in most of the years, the rainfall included in Volume 198 was relatively much higher than that

mentioned in Volume 166 with maximum variation being of the order of 130% for the year 1999.

For Castlerock, the average value of monsoon rainfall included by the witness in his Report of May 2017 (Volume 198) is about 60% more than the average monsoon rainfall indicated in his Report of September 2015 and in most of the years, the rainfall included in his Report of May 2017 is relatively much higher than that indicated in his Report of September, 2015, with maximum variation being of the order of 226% for the year 1982.

The Tribunal was of the prima facie opinion that the variations in data of different rain-gauge Stations included by the witness in his two Reports were erroneous, and therefore, a question was put as to whether the witness had thoroughly checked the data that was made available to him from time to time and which had been used by him for his two Reports and why such major variations were not noticed and/or ignored by him. The answer of the witness was that he had thoroughly checked all the values that had been used in his analysis of

May, 2017 and the variations between his Report of September, 2015 and Report of May, 2017, as depicted in MARK-26, were on

account of the additional data, that was earlier missing and which had become available from IMD. According to the witness the other reason for these variations could have been the result of the application of consistency check.

183.

It was noticed by the Tribunal that rainfall data of the rain-gauge station of Castlerock was used for assessment of yield of Mahadayi basin in various Reports namely;

a. CWC Report of 2003 (Volume 15),

b. Report of Mr. Gosain of September 2015 (Volume 166), and

c. Report of Mr. Gosain of May 2017 Volume (198).

184.

The rainfall data of the rain-gauge Station at Castlerock was furnished to the witness by the State of Karnataka, vide Volume 98 filed on 1.12.2014. On examination of the above stated data the Tribunal had prepared a Table of comparison of rainfall data of Castlerock in mm used for analysis in different Reports and the said Table was given MARK-27, a copy of which was handed over to the witness. A similar exercise

was undertaken by the Tribunal in case of Ponda, Mapuca, Sanguem, Khanapur, Kankumbi, Jamagaon, Amagaon and

Castlerock, and the variations found in Table MARK-26 were pointed out to the witness.

The observed rainfall data as well as the processed rainfall data of the rain-gauge Station at Castlerock as available in different documents and Reports were examined by the Tribunal and a Table of Comparison of Rainfall Data of Castlerock in mm, used for Analysis in different Reports, was taken on record and was marked as MARK-27. A copy of the aforesaid document was also handed over to the witness. From MARK-27, it was evident that Annexure V(xv), page 32 of CWC Report of 2003 provided the observed rainfall data of IMD rain-gauge Station at Castlerock for the period from 1964 to 2001 and it was found that the data of three years, namely 1980, 1982 and 1987 were missing and using the available data, the average monsoon rainfall of IMD rain-gauge Station at Castlerock was found to be 2307 mm. Similar such discrepancies found by the Tribunal, were brought to the notice of the witness and it was put to the witness that: (i) there are considerable considerable variations in the values of rainfall data of rain-gauge station at Castlerock from one Report

to the other; (ii) the data were inconsistent; and (iii) the approach

used for finalizing the data to be used for further analysis, was not at all rationale.

It was further noticed by the Tribunal that no care had been taken by the witness to verify whether the values of rainfall of Castlerock furnished by the State of Karnataka were authentic, correct and reliable, and therefore, he was called upon to offer his response. In reply, the witness mentioned that variations in the Comparison Table (MARK-27) are on account of the fact that due to some reason the data of this Station was not consistent, as it could be made out from the averages provided for various periods as part ‘c’ of the question. The witness mentioned that while preparing the September 2015 Report, since the decision was taken to use the processed data prior to 2001, for all the Stations, as was done in CWC (2003) Report, reprocessing of this data would not have been meaningful. The witness stated that while preparing the May 2017 study, re-processing of the whole rainfall data sets with respect to infilling and consistency analysis was done. According to the witness, as it can be observed from column 4 of MARK-27, the data prior to 1981 was appreciably

different from the data after 1981, as has been indicated by the averages of this period in the last two rows of column 4 of MARK-

27. The witness informed the Tribunal that one could not afford to make any corrections without doing the proper analysis, and it was possible that all these years, before 1980, could have been drought years, but such inference can only be drawn, by performing consistency check, wherein the double mass curve is plotted between the Station in question and a group of adjoining Stations. The witness further asserted that it was through this analysis that in his study of May 2017, this Station of Castlerock was found to be violating the consistency, and correction for consistency was made as per the details given in spread sheet ‘Consistency RF 1964 - 12’of Volume 199. The witness ad mitted that

there were variations of values in Castlerock from one report to other, but there were reasons for the same, which have been enumerated by him in his reply. The witness stated that the data can be inconsistent in the raw form, but proper consistency check had been applied and the consistency of the final processed data had been ascertained. According to the witness, the approach used for finalizing the data series for the Mahadayi

basin yield analysis was rational and every care had been taken to ensure that he was using the most correct and reliable values. This is the sum and substance of the evidence of Prof. A.K. Gosain (RW-1).

757

Oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka

185.

Having discussed the evidence of Professor A.K. Gosain, the Tribunal feels it proper to discuss the evidence of Shri A.K. Bajaj, RW-2, deposing as an expert witness on behalf of the State of Karnataka on the subject of Hydrological Analysis of the Diversions and Utilization by the Upstream States in Mahadayi Basin.

186.

Affidavit in evidence of Shri A.K. Bajaj, deposing as an expert witness, on behalf of the State of Karnataka, was filed on 30.12.2016 (Volume 194). In Para 1 of his Affidavit the witness has referred to his educational qualifications, posts held by him as well as his experience in the field.

187.

In Paragraph 2 of his affidavit the witness has stated that the Govt. of Karnataka through its Chief Engineer (ISW), Water Resources Development Organization requested him to

carry out Hydrological Analysis of Diversion by the Upstream States in Mahadayi Basin, which would also include a water balance analysis in the context of trans-basin diversions of the

Mahadayi waters to Malaprabha Reservoir and Kali Reservoir as planned by the Govt. of Karnataka. The witness has proceeded to state that he had gone through the complaints (the complaints filed by three States to the Central Government), amended Statement of Claims, submissions and other relevant documents filed before the Tribunal by the three States of Goa, Karnataka and Maharashtra, besides other related technical reports and available data, and after studying these submissions and other materials, he had prepared his study titled 'Hydrological Analysis of Diversions and Utilizations by Upstream States in Mahadayi Basin which was annexed by him to his affidavit as Annexure-A (colly). In Paragraph 4 of his affidavit the witness has mentioned conclusions of his Analysis as under:

"(i) There is a large quantity of water in Mahadayi Basin as estimated at around 200 TMC by both the CWC and Prof. A.K. Gosain of IIT Delhi. Out of this water, the present utilisations of Goa are only 9.395

TMC and the planned utilisations being only 38.53 TMC inclusive of the present utilisations (Reply of Goa to interrogatories of Maharashtra and Karnataka at Volumes 102 and 103).

(ii) Even after considering Maharashtra's proposed diversion of 180 Mcum (6.35 TMC), the diversions and utilisations claimed by Karnataka are

not incompatible with the planned utilisations by Goa, in particular the 10 projects in Goa (namely Sonal , Surla, Surla II, Derode I, Mandovi Nanoda, Surla III, Kharmol, Mayada, Khadki weir and Ganjim weir) which are in the shared catchment for utilisation of 10.59 TMC are not likely to suffer hydrologically.

(iii) As against the originally estimated inflows which were the basis for the planning of both Malaprabha Reservoir and Supa Reservoir across Kali river, they have suffered acute shortage of inflows as discussed above and therefore augmentation of inflows into these reservoirs from Mahadayi which is in surplus as discussed above becomes necessary in the larger interests of the inhabitants of the State of Karnataka.

(iv) The non-utilisation by Karnataka or Maharashtra as planned would only result in surplus going to sea.

(v) The maintenance of natural equilibrium of Mahadayi River in Goa would be wholly inconsistent with the principles of water utilisation and management o f the Mahadayi basin."

188.

In Para 1 of Hydrological Analysis, the witness has mentioned about scope of the study, whereas in Paragraph 2 of Hydrological Analysis, the witness has mentioned about Hydrology of Mahadayi Basin. According to the witness in March

760

2003, CWC had done an estimation of the total water availability in the Basin and this estimation made by CWC was based on the regression analysis developed from the gauge data at Ganjim G & D site maintained by CWC (in the territory of State of Goa) for the years 1979-80 to 1997-98; and the rainfall data available with the Indian Meteorological Department, and according to this study, the total available water in the Basin as a whole was:

(i)

(ii)

5652 Mcum (199.6 tmc) at 75% dependability; and

6234 Mcum (220 tmc) at 50% dependability.

189.

The witness further stated that Professor Ashwani

had also estimated the yield in

Kumar Gosain of IIT, Delhi

Mahadayi Basin and his study shows that 5838 Mcum (206.14 tmc) was available at 75% dependability and 6321 Mcum (223.20 tmc) was available at 50% dependability.

The witness has

mentioned that in the CWC study, non-monsoon flows were about 2.67% of the gross monsoon flows which came to about 147.50 Mcum (5.21 tmc) and 162 Mcum (5.72 tmc) corresponding to 75% and 50% dependable flows respectively. The witness pointed out that Govt. of Karnataka has planned diversion of 7.56 tmc from the monsoon flows to Malaprabha

761

Dam for meeting drinking water and other needs of that area, and besides, at Kotni reservoir, as per the study done on yield figures from 1980 to 2009, the surplus water available is varying from nil in some years to 23.787 tmc.

The witness informed in his affidavit that, out of this surplus water, the State of Karnataka had planned to divert about 7 tmc of water by using carryover capacity of Malaprabha reservoir during the monsoon months for meeting the agricultural and drinking water needs in the drought prone areas of the Malaprabha command and adjoining areas and that in addition, 5.527 tmc is planned to be diverted to the Kali Basin.

The witness further informed in his affidavit that Karnataka is proposing to consumptively utilize, a total of 24.15 tmc from the Mahadayi Basin, which inter-alia includes in-basin utilisations, evaporation losses etc. in addition to afore-stated diversions.

190.

In Paragraph 5 of his Hydrological Analysis, the

witness has mentioned that there were no measurements at the Malaprabha Dam site during the planning stage in 1970 when, the project was being formulated, and the yield at the dam site was estimated on the basis of 30 years rainfall records and gauge data of 12 years of a downstream site (Kolchi Weir). The

witness has stated that this was cross verified by using isohyetal methods, and on the basis of records of hydrologically similar catchments. The witness, in clear terms, has stated that the yield at 75% dependability,

on the basis of rainfall record, was

during the performance

of the

adopted as 47.25 tmc, but

project after construction, the inflows started to be recorded giving yield figures at the dam site, and the yield on the basis of the measured series of the 34 years for the period from 1972-73 to 2005-2006, at 75% dependability was 26.76 tmc only. The witness has proceeded to state in his hydrological analysis that, thus, the project report which contemplated an utilization of 44 tmc had to be modified for the revised actual water available and the report titled “Modified

Detail ed Project

Report of

Malaprabha Project” was prepared by the office of the Chief

Engineer, Karnataka Neeravari Nigam Ltd., in the year 2009, for utilization of 27 tmc.

191.

The witness has mentioned in his hydrological analysis that the revised DPR of Malaprabha Project of 2009 was posed to the CWC and the Ministry of Water Resources, Govt. of India for clearance, and in the 100 th meeting of the Advisory Committee of Ministry of Water Resources, held on 9.10.2009,

763

the Malaprabha DPR 2009 was considered and was accepted. By stating the above facts the witness has attempted to show that Malaprabha Reservoir is a deficit reservoir.

192.

In Paragraph 8

of his hydrological analysis, the

witness has referred to hydrology of Kali Reservoir and has mentioned that the catchment area at Supa Dam site across river Kali, which is a west flowing river, is 408 sq. miles (1057 sq.km.), and the average yield estimated on the basis of rainfall was 119.84 tmc (3394 Mcum). According to the witness the construction of the project was started in 1971 and was completed in 1987 and the gross storage capacity at full reservoir level

and maximum water level is 147.54 tmc (4178 Mcum = 5605 Meters and 151.96 tmc (4303 Mcum), respectively, whereas the live storage capacity is 132.73 tmc (3758.4 Mcum). The witness has stated in his analysis that the main components of the project are the Supa Dam with a designed capacity of

147.54 tmc and a power house for hydel generation, and as in the case of Malaprabha Dam, the water yield at the time of planning the project was over-estimated, and the Supa Dam was filled only twice out of 29 years i.e. in 1994 and in 2006, since the start of filling in 1984. The witness has mentioned that the

recorded average yield is only 95.66 tmc, whereas the power potential with the originally estimated yield and storage created in the Supa Dam was 1255 Mw with a head of 488 Mtrs. The witness claimed in his analysis that the maximum annual energy that could be generated is 5605 Mu, but due to shortage of yield, the average annual energy generated is of the order of 3600 Mu only, by the planned diversion of water from Malaprabha Basin to Kali Dam, and the total generation could be augmented by 182 Mu.

193.

In Paragraph 9 of his aforesaid analysis, the witness has dealt with the water needs as claimed by three co-basin States of Karnataka, Goa and Maharashtra, and stated that Kalasa Project Report of 2000 as well as the revised Report of 2010, and Bhandura project report of 2000 and revised report of 2012, indicate that the Government of Karnataka had planned the diversion of about 7.56 tmc of waters from the monsoon flows of River Mahadayi to the Malaprabha sub-basin of the Krishna basin for meeting the drinking water requirements of the twin

city of Hubli-Dharwad, which has the highest priority amongst the uses of water, as per the National Water Policy. What is emphasized by the witness is that the Govt. of Karnataka, in its

765

amended Statement of Claims dated 17.4.2015,

has also

mentioned that it had plans to divert some of the monsoon flows of the Mahadayi to the Kali River for augmenting the generation of electricity under the existing Kalinadi Hydro Power Project. The witness has further mentioned that Karnataka Govt. had also proposed a run-of-the-river scheme on the main river Mahadayi for power generation which would not entail any consumptive use of water.

It is also mentioned by the witness

that besides this, at Kotni Reservoir, the surplus water varying from nil in some years to 23.787 tmc is available, and out of this surplus water, the State of Karnataka had planned to divert about 7 tmc of water to Malaprabha Reservoir for meeting the agricultural and drinking water needs, in the drought prone areas.

194.

In Paragraph 10 of his analysis

the witness has

mentioned about water needs, as claimed by Goa. According to the witness the State of Goa in its amended Statement of Claims dated 23.04.2015 has submitted its long term needs in the Mahadayi river basin, and in Para 189, the State of Goa has listed the water requirement upto 2051 AD, which are: (a) Domestic water supply 208 Mcum; (b) Industrial Water Supply 208 Mcum;

766

(c)

Irrigation 2050 Mcum (d)

Salinity Control 158

Mcum

and (e) Forest Management 50 Mcum, totalling 2674 Mcum by 2051 AD which is equal to 94.4 tmc, but the Govt. of Goa has submitted the project report/preliminary reports in respect of 63 projects in answer given to the interrogatories issued by the States of Karnataka and Maharashtra. The witness proceed to state that the total water requirement for these projects added upto only 37.22 tmc as per Annexure 1-1 of Volume 102 and 38.53 tmc, as per the so titled ‘Detailed Project Reports’ of 63 projects, and lift irrigation schemes, bhandhuras, tanks, drinking water requirement and industrial use. According to the witness, out of these 63 projects only 18 projects for utilization of 17.04 tmc fell in the shared catchment of the Mahadayi basin and even out of these 18 projects only 8 projects are on streams, where Karnataka has not proposed any of its projects, which are: (1) Kodal HEP; (2) Golali; (3) Iverkhud; (4) Ragada II; (5) Avarda; (6)

Nandran; (7) Derode II; and (8) Khandepar.

195.

According to the witness, the utilization by Goa from the balance 10 projects in the shared catchment would be only 10.59 tmc. It has been stated that out of the 10 projects in the shared catchment, only 7 projects were upto Ganjim and the

utilisation from these would be only 8.14 tmc and the remaining 53 projects fell in the catchment of Mahadayi, which would not depend on the flows coming from Karnataka.

196.

The witness has emphasized that the Mahadayi River has little utilization, and at the present, utilisation in Goa is 9.395 tmc, whereas at the present, utilisation in Karnataka and Maharashtra was negligible, and therefore the entire water of 199.6 tmc at 75% dependability, excluding 9.395 TMC of the present utilisation by the Goa is going unused to Sea. What is emphasized is that wastage to Sea has not found favour with Krishna Narmada Tribunals in the past, and even the public policy of India is to avoid wastage.

197.

In Para 11 of his hydrological analysis, the witness has mentioned about plan of the State of Maharashtra at the Virdi Project and several other projects. According to the witness the requirements of the State of Maharashtra are: Irrigation, 132.27 Mcum, Drinking Water needs, 3.65 Mcum (1.65 M.cum in

Mandovi Basin + 2.0 Mcum in Tillari basin), Industrial Water Supply 2.10 Mcum and provision for future development 25.0 Mcum and Evaporation losses 16.30 Mcum, totalling 179.32

Mcum which is equal to 6.35 tmc. It is also mentioned by the witness that Maharashtra, has so far filed information on 4 projects and one DPR of Virdi Project, which proposes utilisation of only 43.396 Mcum.

198.

In Para 12 of his hydrological analysis, the witness has referred to Water Balance Analysis and stated that even if one takes the entire claim made by the State of Goa at its face value, the total water claims of the three States of Goa, Maharashtra and Karnataka add upto 124.90 tmc annually, but the available water as estimated by CWC in Mahadayi basin is much larger being 199.60 tmc annually at 75% dependability and 220 tmc annually at 50% dependability. According to the witness, even if the yield of 199.60 tmc at 75% dependability is considered, there will be a surplus water of 74.70 tmc annually, and therefore, the claims of the three riparian States of Goa, Maharashtra and Karnataka are not incompatible to each other, and there is enough surplus water and potential in Mahadayi basin for all the co-basin States.

199.

This witness was cross- examined at length by the

learned counsel for the State of Goa, and was also put several

questions by the Tribunal, for eliciting the information relating to availability of water. Therefore, the Tribunal propose to deal with only relevant questions put to the witness and answers given to those questions by him. A question was put to the witness by the learned counsel for the State of Goa as to what are the upper and lower limits of run off factor, for the catchment upto Ganjim, beyond which the data for that year would be considered as an outlier.

The answer given by the witness was that there can be no specific two values of upper and lower limits of runoff factors, which can be termed as outlier, and this depends upon the judgment of the Hydrologist carrying out the study, and the final data set arrived at, before deciding the regression equation. The witness categorically stated that he was not aware of the values which were treated as outlier by the Hydrologists, carrying out the study. It was put to the witness by the Tribunal that if he was not knowing even the data details which Prof. Gosain had used in his studies/Report, or even CWC used in 2003 Report, then how and on what basis and on which principles he had agreed

with the Report of the study conducted by Prof. Gosain and/or the CWC (2003) Report.

770

The response of the witness was that he had gone through the CWC (2003) Report, and examined the data available therein, and the procedure used in calculating the yield. According to the witness the Report contained all material data relevant for the study, but they did not contain some of the minor details like the specific values of runoff factor etc., but the general contents of the Report were to his satisfaction, and it is for this reason that he had taken the values of yield derived in the study.

200.

The witness was asked as to whether he was able to show the learned cross-examiner of the State of Goa from his Report or from his affidavit, having stated that the environmental studies should be first conducted or that the necessary permission and clearances ought to be first secured and if not, would it not mean that the support the witness proposed to lend to the projects of the State of Karnataka, proposed in the midst of Western Ghats, would be undermining the implication and the likely adverse effects on the ecological system.

The answer given by the witness was that he had not talked

about the environmental clearances required, or even other clearances required, before taking up these projects. The witness

stated that this was a standard requirement with Government of Karnataka, taking the clearances in the course of proceedings, and going ahead with the construction of these projects. The witness mentioned that his study
is regarding the available
water being sufficient to meet the requirements of the three States, and is not in support of any specific project. The witness clarified that whether the project proposed to be undertaken by the Government of Karnataka would or would not, and how much it would affect the environment, can only be determined by carrying out a proper Environmental Impact Assessment of the project proposed.

The witness proceeded to state that he
presumed that proper process of obtaining all clearances from various agencies of the Govt. of Karnataka for the project to be undertaken, would have been taken.

201.

In his affidavit in evidence, as well as in his Report
dated 30.12.2016 (Volume 194), Page 14, Para 9, the witness has

stated that as per the National Water Policy, the drinking water needs has the highest priority,

and similarly in answer to

Question No.74, the witness has stated that drinking water needs have the highest priority as per the National Water Policy.

Attention of the witness was drawn to Volume 33 (B), i.e

772

Modified Detailed Project Report of Malaprabha Project submitted by the State of Karnataka on 18.3.2013, more particularly, at Page 17, wherein allocation is made for water supply and for industrial purpose as per the revised Project Report. Having drawn the attention to the above stated facts, the learned cross-examiner deduced that it was evident that as per the revised Project Report, the total allocation of water for industrial and drinking water taken together was 0.216 tmc, and a question was put to the witness as to whether this allocation of only 0.216 tmc, was in accordance with the National Water Policy, which the witness had claimed giving highest priority to the drinking water.

The answer given by the witness was that at the time of preparing a revised Project Report

of

an already ongoing

project, generally the existing usages have to be protected and it is probably on this basis that the allocation have been apportioned. The witness categorically admitted that he was not

in a position to say as to why or what were the conditions in the command areas due to which, the Govt. of Karnataka has given the quantities for the purpose as mentioned in Volume 33 (B) at

773

Page 17, and he was not in a position to say whether the allocations were justified or not.

202.

The attention of the witness was drawn to the following facts, by the learned Cross-examiner of the State of Goa:

(a)

At the time of initial estimation of yield in the Malaprabha Reservoir, cultivation of sugar crop, was on the rise in the Northern Karnataka Region. In Volume No. 86 which are answers on behalf of the State of Karnataka to the interrogatories of State of Goa, at Annexure-1 thereof at Page 11, the State of Karnataka has given the figures of area irrigated under Malaprabha Reservoir from 1979-80 to 2012-13. At Col. 1 in Sl. No.1, the figure for 1979-80 for sugarcane crop is 224 Ha., but, for the year 2009-10, the sugarcane cultivation figure has risen upto 3038 Ha. and in the years 2010-11, it has gone upto 3421 Ha.

(b)

The figures given by the office of the Cane Development Commissioner and Director of Sugar are reflected in Annexure 2 at Sl. No.3 at Page 12 of Volume 86. The sugarcane demarcated/allocated, Taluka-wise/District wise for sugarcane development for each of the existing

774

and proposed

sugarcane factories in command of

vide Annexure-1 and

Malaprabha Reservoir are given

Annexure-2 thereof, at Page 13 of the said document,

namely, Volume 86. In respect of the five factories the

area allocated for sugarcane development of the existing

factories works out to 24827 Ha., and in the Table on the

same page, another five proposed sugarcane factories are

reflected.

(c)

The modified DPR of Malaprbha Project [Volume

33(B)] there is no whisper about sugar cultivation or the

area allocated for the same, but in his Report annexed to

the affidavit dated 30.12.2016 (Volume 194), the witness

has dealt at Page 11 therein

with the hydrology

of

Malaprabha Reservoir and that

the witness had

deliberately avoided any reference to Malaprabha Basin as

such or its tributaries.

(d)

In Para 7 of his Report on Page 12, the witness had

concluded, based on the revised DPR of 2009, that

Malaprabha Reservoir is a deficit reservoir.

After pointing out

the above mentioned facts to the

witness, the learned Cross-examiner had put questions as to why

the witness had, instead and in place of dealing with Malaprabha Basin and its tributaries dealt with only the reservoir, conveniently leaving out a large portion to the extent of 80% of the water in the Malaprabha basin. The witness was also asked as to why he had not dealt with or addressed the issue of large scale untamed and uncontrolled rise in sugarcane cultivation, which consumes the water from the Malaprabha reservoir in his Report, and whether the Witness had, before undertaking or carrying out the study which had culminated in the Report, undertaken an enquiry as regards 2009 modified DPR vis-à-vis the answer given in Vol.86 by the State of Karnataka, which display figures from 224 Ha. in 1979-80 to 3038 Ha. in 2009-10, as also the other figure of 24827 Ha. as mentioned earlier.

In answer to the said question, the witness stated that he had dealt with the water available in the Malaprabha Dam Reservoir, as this was the utilisable water, and for harnessing the water flowing in the rest of the basin, proper infrastructure would have to be provided. According to the witness he was

discussing the limited issue of reduction in the flows to the reservoir in his Report and not the cropping pattern in the

command, and as such he had not addressed
the issue of
cultivation of sugarcane in the command, in his Report.
The witness candidly admitted that he had not undertaken
the detailed study of sugarcane figures ranging from 224 Ha. In
1979-80 to 3038 Ha. In 2009-10 or the worked out figure of
24827 Ha mentioned by the Cane Development Commissioner
allocated to the five factories.

203.

The witness was made aware of the fact by the
that the total catchment area
of
learned cross-examiner
Malaprabha Basin is 11549 sq.km., whereas the total catchment
area of Malaprabha Dam Reservoir is only 2204 sq.km. and from
the perusal of his Report, it appeared that he had restricted his
study to only Malaprabha Dam Reservoir, catchment of which
constituted approximately 20% of the total catchment area of
Malaprabha basin. Having been so aware about the ratio of

catchment area of Malaprabha Dam Reservoir, question was put to the witness as to why he had restricted his study to only Malaprabha Dam Reservoir and not extended it to the whole of the basin.

777

In answer, the witness stated that he had considered the water availability upto the Malaprabha Dam site only, as this was the utilisable water available to the Project Authorities for meeting the various requirements in the command of Malaprabha Project, and for meeting the drinking water requirements being fed from the reservoir. The witness mentioned that he did not consider the water available in the balance Malaprabha basin, as, in order to utilise the water available in the balance catchment, further infrastructure projects would have to be taken up.

204.

In view of the above stated answer, a question was put to the witness as to whether he meant that based on his Report dated 30.12.2016, it could not be deduced or found out as to whether the Malaprabha basin, as a whole, is deficient basin or not and the witness answered that it was correct.

205.

The attention of the witness was drawn

to the

document MARK-GOA/12, which was the interview given by the witness, and more particularly to a question and an answer

given by the witness to the said question.

The aforesaid

question and answer from the interview were reproduced:

“ **Givean insight into the CAD&WM programme launched by the Government** .

Government of India has launched the Command Area Development and Water Management (CAD&WM) programme with the objective of developing the last mile irrigation infrastructure for delivering the water to the fields. This addresses the issue of micro level infrastructure development and efficient water management at the farm level. The programme also includes actions required for correction of system deficiencies besides the development and management activities below the outlet. Efficient water management cannot be achieved unless the infrastructure for water conveyance and delivery system is in good condition to retain its operational efficiency” .

206.

Thereafter a question was put to the witness to the effect that whether from his report dated 30.12.2016 (Volume 194), he was in a position to show that before commenting on the fact that Malaprabha reservoir is a deficit reservoir, all the requirements for correction of the system for efficient water management had been carried out by the State of Karnataka, with respect to the infrastructure for water conveyance.

779

The answer given by the witness was that he was not in a position to show from his Report dated 31.12.2016 whether before commenting on the fact that Malaprabha Reservoir is a deficient Reservoir, all the requirements for correction of the system for efficient water management had been carried out by the State of Karnataka with respect to the infrastructure for water conveyance.

207.

It was brought to the notice of the witness that the total catchment area of Kali Basin is 4843.3 sq.km., whereas the total catchment area of Supa Dam Reservoir is only 1056.72 sq. km. but from the perusal of his Report it appeared that he had restricted his study to only Supa Dam Reservoir, catchment of which constituted approximately 25% of the total catchment area of Kali Basin, and therefore, a question was put to the witness as to what was the reason to restrict his study, only to Supa Dam reservoir and not to extend it to the whole of the basin.

The answer given by the witness was that it was correct

that he had considered the catchment up to the Supa Dam Project site only, as it was the only water that is utilisable for generating power.

780

208.

Another question that was put by the learned counsel for the State of Goa was that based on his Report dated 31.12.2016, it could not be deduced or found out as to whether Kali Basin as a whole was a deficit basin or not and the response given by the witness was that he agreed that based on his report dated 31.12.2016, it could not be deduced or found out as to whether Kali Basin as a whole, was deficit basin or not.

209.

The learned Cross-examiner wanted whether he to know from the witness as to had personally verified and checked the facts and figures, data and its application, as well as the choice of rainfall stations and the Thiessen Polygon done in the Report dated 12th September 2015, by Prof. A. K. Gosain, (Volume 166), before agreeing with the same, and if not, why had he not done so when he was knowing that his report would

be presented as evidence by one of the parties to the dispute before the Tribunal. In response, the witness stated that he had not done a detailed analysis of Professor Gosain's Report regarding the facts and figures, data and its application, as well as the choice of rainfall stations, and the Theissen Polygon done in the Report.

The witness however, claimed that he had verified the contents and facts and noticed that it was basically

an extension, with subsequent data, of the CWC (2003) Report, and the final yield figures were also more or less matching with the results of the CWC (2003) Report.

210.

The witness was informed by the learned cross examiner that there were two major tributaries on the right bank of Malaprabha River i.e. Joul Nala and Bennehalla Nalla and that Joul Nalla has a catchment area of 224 sq.km., whereas the Bennehalla Nalla had a catchment area of around 5048 sq.km., which is more than twice the entire Mahadayi basin area, and a proposal to utilise the water of Bennehalla Nalla was prepared by Shri Sudheer Sajjan, who is/was an Engineer with the Water Resources Department of Government of Karnataka and that while answering a question put by the Tribunal he had admitted that he had been provided with the Report submitted by Shri Chetan Pandit, the expert witness for the State of Goa. It was further brought to the notice of the witness that in his proposal Mr. Sajjan had estimated the yield of Bennehalla Nala as 10.92 tmc on 75% dependability of which, as per the same proposal,

hardly 1.5 tmc had been put to use. Having pointed out the above stated relevant facts, the witness was asked as to why in his Report, while considering the availability of water for

782

Malaprabha Reservoir, he had not considered this important aspect. The witness responded that the document Annexure-D at Page 146 of Volume 192 of Additional Affidavit of Examination-in-Chief, Shri Chetan Pandit was mentioned as a Flood Control Scheme, and as such he did not consider it for the purpose of water availability. He further stated that he was not in a position to say as to whether it was technically feasible or not to divert this water to the Malaprbha Reservoir.

211.

It was brought to the notice of the witness by the

of

Goa

that Annexure-D

learned counsel for the State

mentioned in Question No.108 dealt with, and was cited as "Flood Control and Utilization of Water in Bennehalla Basin – a Scientific Proposal",

and that the very

first line mentions

Bennehalla Basin is the biggest tributary of the Malaprabha river. Therefore, it was put to the witness that Annexure-D was not a Flood Control document, as mentioned by the witness, but indeed it spoke of utilization of water also. The cross-examiner put to the witness that he had not considered this important document annexed to the Affidavit of Shri Chetan Pndit, wherein the study made, an attempt to propose a major diversion scheme for its utilisation, and that having not adverted to this

important document, which would have thrown much light on the reasons for the deficiency of water, if any, in Malaprabha reservoir, as well as the remedy which was available within the Malaprabha basin, the report of the witness fell short of the required level of a study to be presented as an expert evidence before the Tribunal and his response was sought.

In answer thereto, the witness stated that there was no techno-economical feasibility study for diversion of this water from Bennihalla tributary and it was for this reason that he had not included in his study the possibility of whether or not this quantity of water or any lesser quantity therefrom, could be diverted

to the Malaprabha Reservoir.

The witness further

explained that it is definitely possible to divert water from both the sources, the present proposal of Govt. of Karnataka from Mahadayi, as well as from Behhihalla, after making a detailed study and D.P.R. for this diversion.

212.

In view of the above stated answers given by the witness it was noticed by the Tribunal that while answering Question No. 108 put to the witness by the learned cross-examiner for the State of Goa, the witness had stated that the

document Annexure-D at Page 146 of Volume 192 was mentioned as a Flood Control Scheme, and as such he had not considered it for the purpose of its water availability, whereas while answering Question No. 109, the witness had attempted to provide some other justification for ruling out the said document. The Tribunal had, therefore, put to the witness that once as admitted by him earlier, he had even chosen not to take into consideration the said document, the question of providing some other justifications for not considering the same as being not the proper solution to the problem posed a question would not even arise and, therefore, the witness was required to offer his explanation. The witness gave following reply:

“I wish to apologize if answers to the two questions are contradictory to each other and seek indulgence of the Hon’ble Tribunal”.

213.

The attention of the witness was drawn to document MARK-GOA/12 i.e. his own interview and the question and

answer to the said question at Page 1 wherein the witness had stated that “few large rivers like Brahmaputra and Ganga (particularly their northern tributaries), Mahanadi, Godavari and rivers originating from the Western Ghat, have been found to be

surplus in water resources. India can capitalise on the surplus water by diverting water from these rivers to other parts of the country which are deficient in water. This will help to reduce the regional imbalance and benefit will accrue in terms of additional water for irrigation, domestic and industrial water supply, hydro power generation and navigational facilities. A Master Plan for this has been prepared after a proper technical examination under the o verall scheme of inter linking of rivers."

Having

brought necessary facts to the notice of the witness, the learned Cross-examiner put it to the witness as to why river Mahadayi, though originating from Western Ghats, has not been mentioned therein to be a river of surplus in water resources, and further whether a technical examination of the diversion of waters of Mahadayi outside the basin being carried out by any Central Agency, namely, NWDA, Planning Commission or Ministry of Water Resources.

The response given by the witness was that during his aforesaid

interview, he had mentioned

a few rivers like

Brahmaputra, Ganga, Godavari, Mahanadi and a general term

“rivers of Western Ghats” as an example of some of the rivers

with surplus water. According to the witness as it was not an

exhaustive list of the rivers having surplus waters, the name of Mahadayi was not appearing in his aforesaid answer in the interview.

The witness further stated that he was not in a position to say as to whether any Central Agency, named in the question, had carried out any proper technical examination of the water diversion of waters of Mahadayi outside the basin.

214.

After the cross-examination of the witness by the learned counsel for the State of Goa was over, Shri D.M. Nargolkar, learned counsel for the State of Maharashtra was requested to examine the witness, but he stated that he had no questions to ask this witness. Shri Brijesh Kalappa, the learned counsel for the State of Karnataka also stated that no opportunity for any re-examination of the witness was required.

215.

Thereafter the Tribunal had put certain questions to the witness, to elicit best information relating to the availability of water in Mahadayi Basin. It was brought to the notice of the

witness by the Tribunal by putting Question No.6 that the contents of Para 4 on Pages 9-10 of his affidavit are based on the information and data included in the Statement of Claims of the State of Karnataka, and other related documents filed by the

State of Karnataka, from time to time. Therefore, the witness was asked as to whether he had undertaken any studies with additional data and information to review, and/or update the findings of earlier studies and if so, the results thereof. The witness stated that that the Govt. of Karnataka had planned diversion of 7.56 tmc from the monsoon flows to Malaprabha Dam for meeting drinking water and other needs of that area and the witness was required to inform the Tribunal regarding:

(i) The quantum of water planned to be utilized for drinking purpose; and

(ii) The quantum of water planned to be utilized for meeting other needs and to clearly specify the various needs and water planned to be used for each and specific needs.

216. It was noticed by the Tribunal that the witness had mentioned that at Kotni Reservoir, as per the study done on yield

figure from 1980 to 2009, the surplus water available was varying from nil in some years to 23.78 tmc, and therefore, a question was put to the witness as to which was the said study and whether it is on record of this case or is it reflected in a study and

788

why the data after the year 2009 had not been used to update this study.

217.

It was also noticed that the witness had stated that Karnataka was proposing to consumptively utilise a total of 24.15 tmc from the Mahadayi basin, which inter alia includes in-basin utilisation, evaporation losses etc. in addition to Therefore, the witness was required diversions. to inform the Tribunal about complete break-up of 24.15 tmc of water including (i) Quantum of water proposed to be diverted out of Mahadayi basin for irrigation; (ii) Quantum of water proposed to be of diverted out of Mahadayi basin for irrigation (iii) Quantum water proposed to be diverted out of Mahadayi basin for hydro-power generation; (iv) Quantum of water proposed to be diverted out of Mahadayi basin for any other purpose; (v)

Quantum of water to be used within Mahadayi basin for drinking purposes; (vi) Quantum of water to be used within Mahadayi basin for irrigation; (vii) Quantum of water to be used within Mahadayi basin for hydro-power generation; (viii) Quantum of water to be used within Mahadayi basin for any other purpose; (ix) Quantum of water earmarked towards evaporation from

reservoir; (x) Quantum of water earmarked for any other losses through the planned projects.

The response given by the witness was that he had not undertaken any study with additional data in order to review and/or update the findings of earlier studies. The witness expressed his inability to give a specific break up of the diversion of 7.56 tmc for drinking water purposes and for meeting other needs. The witness stated that as per the proposal of Govt. of Karnataka, the quantity of water is proposed to be transferred to Malaprabha Dam to augment the water availability and then the utilisation will be according to various needs. The witness further mentioned that water is planned to be used for augmenting water supply to the twin city of Hubli-Dharwad and some other nearby areas which are not being provided with water from the Dam, and there is also a reference to some small quantities of water being utilized for irrigation also. The witness

stated that he was not in a position to say as to why the data after 2009 had not been used to update his study and that he was not aware of the detailed break-up of 24.15 tmc uses referred to in Question.

790

218.

The attention of the witness was drawn to Para 14 on Page 10 of his affidavit, as well as Para 13.2 on Page 93 of the amended Statement of Claims by the State of Karnataka (Volume 129). It was also brought to the notice of the witness that the availability of water at (i) Bhandura Dam site and (ii) Kalasa Dam site, including portion of Haltara Nalla and Surla Nalla had been assessed by Prof. A.K. Gosain, expert witness of the State of Karnataka in his Report of November 2016 (Volume 193), and relevant information in respect of Bhandura Dam site were culled out from Table 4 at Page 15, Volume 193 and water availability at 75% dependability was computed by the Tribunal, and the witness was confronted with the results thereof.

219.

It was brought to the notice of the witness that the available water at Bhandura Dam site at 75% dependability, assessed by Prof. Gosain, was only 3.675 tmc, against the proposal of diverting 4 tmc from Bhandura Dam site, and thus

the diversion of 4 tmc from Bhandura Dam site was not feasible, and as a result, the proposal for diversion of 7.56 tmc from Kalasa Nalla diversion and Bhandura Nalla, taken together would also be not feasible. It was noticed by the Tribunal that Shri Chetan Pandit, an expert witness of the State of Goa had

also assessed the water availability
at 75% dependability at
Bhandura Dam site and Kalasa Nalla site and were indicated as 1.4961 tmc and 1.9767 tmc, respectively, in Table 1 at Page 4 of the additional affidavit of Shri Chetan Pandit (Volume 196). It was further noticed by the Tribunal that the quantum of water available for diversion would get further reduced after taking into consideration the demand of water, for various purposes and mandatory environmental requirements, particularly by those for Karnataka region in the down stream reaches of proposed Kalasa Dam, Haltara Dam and Bhandura Dam.

Under the
circumstances the witness was called upon by the Tribunal to inform as to whether he was endorsing a proposal which was apparently not feasible in its present form.

The answer given by the witness was that the earlier studies conducted by the Govt. of Karnataka did not indicate 4 tmc of water available for diversion at Bhandura pick up point, but the studies by Professor Gosain indicated the lesser amount

of water of 3.675 tmc at Bhandura Dam site and this meant that the dependability of the proposal would reduce from 75% to a lesser percentage of 70%, as indicated in the Table 4 referred to in the question. The witness further stated that regarding the

diversion of 3.56 tmc from Haltara Kalasa sites, the water availability figure as per the Table No.4 was indicated as 3.8 tmc at 75% dependability, whereas regarding the figures of water availability worked out in the Report of Shri Chetan Pandit, he had not taken those figures into consideration, as the Report suffered from some inconsistencies and the figures were not reliable. The witness also explained that the mandatory releases for environmental requirements and various other purposes, if any, would have to be made at the time of operation of these projects and these releases would further reduce the water available for diversion from the Bhandura point.

220. Further, the attention of the witness was drawn to Para 5 on Page 11 of his affidavit wherein he has stated that initially the yield of Malaprabha Reservoir was estimated to be 47.25 tmc at 75% dependability on the basis of observed gauge data of 12 years at Kolichi Weir site and 30 years of rainfall, and after cross verification with the records of hydrologically similar

basin, the figure of 47.25 tmc was adopted. However, it was also noticed by the Tribunal that in Para 6 at Page 11, the witness has stated that the yield on the basis of measured series of 34 years for the period from 1972-73 to 2005-06 at 75%

dependability, was 26.76 tmc only, and thus the estimated yield of 47.25 tmc at the time of planning was on a very high side. The Tribunal was of a prima facie view that these two figures did not match and therefore there was an error somewhere in the assessment. Under the circumstances a question was put to the witness as to whether he had examined as to what led to such erroneous assessment and what measures he would suggest for ensuring that such errors are avoided during the course of planning in future.

The witness responded that, he did not feel that

the

hydrology of the project, as worked out in the earlier Project Report as 47.25 tmc, was erroneous and hydrology was based on the available hydrological data and was checked by CWC before approval

being granted by the Planning Commission to the

Project Report in 1963. According to the witness the figure of 26.76 tmc in the revised DPR was on the basis of annual inflows into the reservoir from 1972-73 to 2005-06. The witness further

mentioned that hydrology of any proposed project, to be taken up in future, should be done only after long term data is available, which could avoid such type of over or under estimation, besides observing due care in processing of the data.

794

221.

The attention of the witness was drawn to what he had stated in Para 8 on Page 13 of his affidavit and it was pointed out to him that the information included in the said Para was limited to average yield and no information related to yield at 75% dependability, was provided. Similarly, it was brought to the notice of the witness that he had not provided any at 90% dependability which is information relating to yield generally taken into consideration while planning hydropower projects. Under the circumstances, three questions were put to the witness, namely: (a) as to why the live storage capacity of 132.73 tmc i.e. about 10% more than the then assessed average yield of 119.84 tmc at the Project site was considered necessary; (b) whether he had examined the relevant data and information to identify the possible reasons for erroneous assessment of yield on higher side at the time of planning and what measures

he was suggesting to ensure that such errors were avoided during the course of planning of future projects; and (c) as to whether he did not agree that average yield estimated at 119.84 TMC and the live storage capacity estimated at 132.73 tmc were wrong and erroneous because the yield was only 95.66 tmc.

795

The witness answered that he was not in a position to comment on the reason why the live storage capacity was fixed at 10% more than the average yield as that decision was taken by the officers of Karnataka Government framing the Project Report. The witness further stated that he had gone through the hydrology of the Project as it appeared in Volume 100 (b) but it was not appropriate to say that this was an erroneous assessment of yield on higher side at the time of planning. The witness maintained that the Project Report prepared by Government of Karnataka officials must have been prepared with due care, and it had been checked by the Central Agencies for its correctness, before being accorded an approval. The witness referred to his answers given to Question No.12, and stated that generally the Hydrology for any project should be worked out on the basis of long term data which then takes care

of any abnormal figure for a few years in the data set and that he did not agree
with the suggestion that the average yield
estimated at 119.84 tmc and the live storage capacity estimated
at 132.73 tmc, were wrong and erroneous.

796

222.

The answers given by the witness to Question No.74 and Question No.75, put by the learned Sr. Counsel for the State of Goa on 14.9.2017, were brought to the notice of the witness and apprehension was expressed on behalf of the Tribunal that the reply raised serious issues relating to sanctity of provisions of National Water Policy as well as State Water Policy of the Govt. of Karnataka, in respect of the first priority assigned to drinking water needs. The witness was informed that the aforesaid issue becomes more severe and worrisome in respect of Malaprabha Dam, in view of the reported changes in the cropping pattern, in accordance with the areas of sugarcane crop requiring more waters. It was noticed by the Tribunal that the witness had chosen not to reply those queries, stating that he had not undertaken the detailed study of the sugarcane figures ranging from 224 Ha. in 1979-80 to 3038 Ha. in 2009-10 or the worked out

figures of 24827 Ha.

mentioned by Cane

Development Commissioner.

Further it was noticed by the

Tribunal that the State of Goa had highlighted the issue of

supply of Malaprabha water to Pepsico unit of Dharwad by the

Karnataka Water Board, which also raises the issue of priority of

allocation of water for commercial purposes, while the twin city

of Hubli-Dharwad were facing reported serious crisis of drinking water for local population.

Under the circumstances a question was put as to why the witness did not examine all these issues at the time of preparation of his affidavit and Report of December 2016, as most of the related information, were available in the documents filed by the party State. Another question which was put to the witness was as to why did he not feel that his Report was deficient on account of many important aspects, not having been examined in proper perspective.

The answer given by the witness was that he had not discussed the issue of water allocation from Malaprabha Dam Project with the Project Engineers and the reasons for not withdrawing water from the existing agricultural uses and diverting it to drinking needs of the twin city of Hubli-Dharwad. According to him, he was informed that there was severe stress

in the existing command and in fact there was a demand for more water. The witness mentioned that it was not possible to divert
water from the existing agricultural uses to drinking purposes at the time of framing the revised DPR, and regarding

the sugarcane areas under cultivation, the figures indicated in the allocation letter of the Cane Development Commissioner he was informed that although this land had been allocated for sugarcane cultivation, the actual area under sugarcane cultivation was a very small percentage of the allocated area because of severe shortage of water. The witness proceeded to mention that regarding allocation of water for industrial purposes to the Pepsico Factory, he was not in a position to say with surety about the reasons for doing so, more particularly, since the quantity allocation had not been indicated and he had not come across the same while preparing his study. The witness denied the suggestion that his Report was deficient on account of many important aspects not having been examined

by him in proper perspective.

223.

The attention of the witness was drawn to Question No.71 put by the learned Senior Counsel for the State of Goa on 13.9.2017 and his reply thereto, and it was pointed out to him that the witness on referring to both the National Water Policy 2012 (MARK KA/4), as well as National Water Policy of 2002 (MARK KA/13) and a prima facie view was expressed by the Tribunal that it was felt that once NWP 2012 was in place, all

previous versions of National Water Policy stood replaced, and that the provisions of latest version i.e. NWP-2012 should have guided actions for planning and management of water resources. From the Report given by the witness, a prima facie impression was gathered by the Tribunal that he had looked at relatively very complex water related issues in a highly simplistic manner by selectively citing specific provisions of the NWP-2012, which itself was against the basic principles identified in Para 1.3 of NWP-2012 and that the witness had not taken into consideration the contents of said Para 1.3, which identifies the basic principles to be borne in mind, while looking at relatively complex water related issues.

Under the circumstances, a question was put to the witness that as to whether he felt the

need for considering the provisions of NWP-2002, when the same was replaced by NWP-2012. Another question put as to whether the basic principles listed at Para 1.3 of NWP-2012, and all related provisions of NWP-2012, were considered during the process of techno-economic appraisal of the water resources projects in the Central Water Commission
manner.
and if so, in what

800

The answer given by the witness was that basically he had relied on the provisions contained in NWP-2012 only, and his statement on 14.9.2017 referring to the NWP-2002 was only to say that the drinking water had always been a priority. The witness further informed that he had retired from Central Water Commission in 2011, whereas the provisions relating to latest NWP are of the year 2012, and therefore, he was not in a position to indicate whether or not, the basic principles listed in Para 1.3 of NWP-2012, and all related provisions of NWP-2012, were being duly considered

during the process of

techno

economic appraisal of the water resources projects in the Central Water Commission.

224.

It was noticed by the Tribunal that National Water Policy 2002 was in place at the time of preparation of “Modified Detailed Project Report of Malaprabha Project” prepared by the Government of Karnataka, and its techno-economic appraisal by

the CWC. It was brought to the notice of the witness that NWP-2002 provided for collection of reliable data regarding water availability
and actual water use, collection of information
relating to ground water resources and its consumptive use, and planning of water resources, development and management, for

801

a hydrological unit, such as drainage basin as a whole or for a sub-basin, multi-sectorally, taking into account

surface and

ground water for sustainable use incorporating quantity and quality aspects as well as environmental consideration etc. It was further noticed by the Tribunal that all individual and developmental projects and proposals should have been formulated and considered within the framework of such an overall plan, keeping in view the existing agreement/award for a basin so that the best possible combination of opinions can be selected and sustained.

225.

Therefore, the Tribunal had asked a question to the

witness as to whether reliable data regarding water availability and actual water use including that for respective water needs for twin city of Hubli-Dharwad were collected and considered for Malaprabha Sub-basin as a whole before planning

Malaprabha Project

and whether

for

these aspects were

considered during the course of techno-economic appraisal of

the Malaprabha Project. It was further asked by the Tribunal, as

to whether the future water needs

for various purposes,

including that for twin city of Hubli-Dharwad were scientifically

assessed and examined with reference to Allocation Priorities.

802

Yet another question put to the witness was as to whether ground water potential was assessed on a scientific basis and duly considered for incorporating and carrying development of surface and ground water in respect of Malaprabha Project, and if yes, particulars be provided. The last question which was put by the Tribunal was as to what was the total water availability for Malaprabha Sub-basin and what was the percentage usable water.

of

The witness answered that as per his information data for drinking water requirements of Hubli-Dharwad were considered at the time of preparing DPR. The witness further stated that he was not able to state regarding up to what future date the requirements were projected in the revised DPR. The witness also expressed his inability to provide particulars regarding the ground water potential assessed and the provisions made for integrated use of surface as well as ground water and that, he was not able to give the figure of total water availability of the Malaprabha sub-basin whereas the

percentage of utilisable

water was not readily available with him. It was brought to the

notice of the witness that National Water Policy 2002 accorded

highest priority

to drinking water,

and calls for providing

adequate safe drinking water, both in urban and rural areas, and therefore a question was put to the witness as to why necessary provisions were not made to meet the full requirements of drinking water of the region including that of the twin city of Hubli-Darwad before allocating water for irrigation and other purposes in “Modified Detailed Project Report”. The witness was further asked as to on what basis the allocations of 0.201 tmc water only was made for drinking and industrial purposes, in the Modified Detailed Project Report of Malaprabha Project.

The answer given by the witness was that the existing water uses for irrigation etc. had to be protected while framing revised DPR, and it was not possible to divert water from there for the drinking water requirements. The witness further stated that he was not in a position to say why only 0.201 tmc had been

provided for drinking water, as this decision was taken by the Project Engineer, while framing the revised DPR.

This is the sum and substance of the evidence of Shri A.K. Bajaj, (RW-2).

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - V

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – V

Sl. No.

1.

D E S C R I P T I O N

Details of oral evidence led by the Party

States contd…

- **Oralevidence of MW-1 Shri S.N.**

Huddar for the State of

Maharashtra

- **Oralevidence of AW-2 Shri Paresh**

Porob for the State of Goa

- **Oralevidence of AW-3 Dr. Shamila**

Monteiro for the State of Goa

- **Oralevidence of AW-4 Shri**

Rajendra P. Kerkar for the State of

Goa

- **Oralevidence of AW-5 Shri Subrai**

T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M.

Jamdar for the State of Karnataka

804 - 836

PAGE NOS

836 - 856

856 - 865

865 - 877

877 - 913

914 - 929

- **Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka**
- **Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra**

2. Evaluation of the oral evidence led by the three Party States

- **Findingson conflicting results arrived at by the Experts relating to water availability**
- **Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology**
- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of**

Karnataka

Evaluationof oral evidence of RW-

2 Shri A.K. Bajaj for the State of

Karnataka

b

929 - 946

946 - 954

954 - 955

955 - 966

966 - 970

971 - 984

984 - 1016

1017 - 1030

Evaluationof oral evidence of

MW-1 Shri S.N. Huddar for the

State of Maharashtra

Evaluationof oral evidence of AW-

2 Shri Paresh Porob for the State

of Goa

1030 - 1039

1040 - 1052

c

804

DETAILS OF ORAL EVIDENCE LED BY THE PARTY STATES CONTD…

Oral Evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra

226.

Having discussed the evidence of Shri A.K. Bajaj, expert witness of the State of Karnataka, the Tribunal now proposes to consider the evidence of Shri S.N. Huddar, who has filed affidavit dated 13.09.2015, filed on 15.09.2015 [Volume 163(a)].

227.

The Examination-in-Chief of Shri S.N. Huddar, MW1, witness for the State of Maharashtra, was recorded on 22.09.2017. During the course of his Examination-in-Chief, he had produced his affidavit dated 13.09.2015 [Volume 163(a)]. The witness had mentioned that there were certain errors in his affidavit, which need to be corrected. According to the witness, the said errors had crept in, because at the time of filing of his affidavit he had not adverted to Volume 102, filed by the State of Goa on 24.12.2014 and the errors to be corrected were

mentioned by him. The aforesaid corrections, requested by the witness, were permitted to be carried out and the corrections were carried out accordingly.

228.

From paragraph 1 of his affidavit it is evident that he retired in September, 2006 from service as the Secretary (CAD), Water Resources Department, Government of Maharashtra, Mumbai.

229.

In paragraph 1, 1.1 as well as 1.2, the witness has mentioned about his professional qualifications as well as the expertise he has in the field of hydrology. In paragraph 1.3, he has stated that he was requested by the Government of Maharashtra in August, 2015, to study the water availability in the Mandovi Basin (Mahadayi Basin) and depose before the Tribunal regarding Maharash tra's case for water availability in the Mandovi Basin, as well as Maharashtra's contribution in the Mandovi Basin. He has stated that he is working as an Advisor to the Government of Maharashtra, in the matter relating to

Mahadayi Water Dispute.

806

230.

In paragraph 1.4 of his affidavit, the witness has claimed that the Government of Maharashtra had made available the records submitted by all the three riparian States before the Tribunal and that he has acquainted himself with the facts of the Mahadayi river case.

231.

In paragraph 2 of his affidavit the witness has discussed the topic of availability of water in river basin and in paragraph 2.4 the witness has mentioned that in order to estimate the availability of water flows, it is essential to obtain data of observed flows, upstream utilization for various purposes, estimation of evaporation losses in the river system and return flows coming back to the river system. According to the witness, the accuracy of assessment of the water availability, thus, depends upon the accuracy of discharge observation, accuracy of utilization data, evaporation losses from water body and availability of return flows from various uses.

232.

Brief history of water availability studies carried out in Mandovi Basin is referred to by the witness in paragraph 3 of his affidavit. The witness has referred in paragraph 3.3(a) to the finding recorded by Dr. Swaminathan Committee and has stated

807

that the total runoff based on the assessment of CWPC is as follows:

“River

Catchment area in

Sq.Km.

1550

Run-off in

Mcum.

3580.04”

Mandovi

233.

The witness has thereafter referred to the estimates made by the National Water Development Agency (NWDA), created by the Union Government, to assess the availability of surplus water and “Preliminary Water balance study of Mahadayi (Mandovi) basin in July 1989” as mentioned in paragraph 3.3(b) of his affidavit. According to the witness NWDA used the co-relationship for computing the yield series for the period 1901-02 to 1985-86 for the entire basin and the average percentage of

non-monsoon observed runoff to gross monsoon runoff at the Ganjim site was worked out and adopted to compute annual yield, which is as under:

“At 75% dependability – 3164 Mm 3

At 50% dependability – 5703 Mm 3 ”

808

234.

According to the witness, NWDA has also included in its report proposed import of 227.75 Mcum of water through the ongoing Tillari Project being constructed in Chapora basin, and the total water resources of the basin from surface water as assessed are given as under:

a) Yield at 75% dependability Import Total	3 3164 Mm 3 228 Mm 3 3392 Mm
b) Yield at 50% dependability Import Total	3 5703 Mm 3 228 Mm 3 5931 Mm

235.

In paragraph 3.3(c), the witness has referred to the estimates made by CWC and stated that the virgin monsoon runoff data has been converted to depth by dividing the volume runoff by catchment area. It is further stated that regression analysis has been carried out using the monsoon catchment rainfall and concurrent runoff and best fit R-R relation obtained, ignoring inconsistent data of monsoon rainfall/runoff points as

809

per standard practice. The witness has mentioned the R-R relation thus obtained, as under:

“RO = 0.87891 x P -49.6451

Where RO - monsoon runoff in mm

P - monsoon rainfall in mm"

The dependable annual yield figures are given below-

50% dependable yield – 6234 Mcum.

75% dependable yield – 5652 Mcum.”

236.

The witness thereafter, has referred to estimate made by the State of Karnataka in paragraph 3.3(d) and has stated that Karnataka has furnished the yield from their part of catchment of Mahadayi basin as 1242.23 Mcum (43.87 tmc) at 75% dependability and 1419.49 Mcum (50.13 tmc) at 50% dependability.

237.

The witness has referred to Water Availability Estimate for the Mahadayi River Basin by Indian Institute of Science, Bangalore in paragraph 3.3(e) of his affidavit and has

810

stated that the results of the analysis of I.I.Sc, Bangalore, are as under:

“VARIOUS STUDIES CARRIED OUT BY

INDIAN INSTITUTE OF SCIENCE (I.I.Sc), Bengaluru

Sr. No.	Study carried by Model	Yield @			
		75%		50%	
		Mcum	TMC	Mcum	TMC
1	Annual Model	6767	238.98	7171	253.25
2	Monthly Model	6354	224.39	6886	243.18
3	ANN Model	5740	202.71	6223	219.77
4	SWAT Model	5376	189.86	6151	217.23

”

238.

The Goa’s estimate has been mentioned by the

witness in paragraph 3.3(f) of his affidavit and has stated that the

State of Goa has not furnished its assessment of yield from Mandovi basin, in its Statement of Case. According to the witness, the State of Goa got the matter studied from IIT, Bombay and this study has been submitted by the State of Goa to the Tribunal on 22nd December, 2014.

239.

The witness has further mentioned in paragraph 3.3(g) of his affidavit, Water Availability Studies for Mandovi River Basin by Indian Institute of Technology, Mumbai (IIT-Powai). The

witness states that the IIT (Powai) has considered the data of Ganjim Gauge site as observed by CWC, but it has converted the discharge measurement considered by CWC by applying the ratio of average flows of float and current meter discharges. The witness has proceeded to mention that it has based its studies on the corrected discharge at Ganjim and considered the rainfall data up to 2005 to arrive at the water availability of the basin. According to the witness, from the study after correcting the discharge and re-estimated rainfall from influencing station, the 75% and 50% dependable annual runoff in the entire Mandovi River Basin is worked out to be 4110.79 Mcum (145.05 tmc) and 4632.178 Mcum (163.45 tmc) respectively. The witness has informed by way of filing his affidavit that they computed the yield by considering the reduced catchment area of Mandovi as 1523 sq.kms. i.e. by deducting the area of 509 sq.km. being saline zone and the 75% and 50% annual yields based on above considerations have been estimated to be 3081 Mcum (109 tmc) and 3472 Mcum (123 tmc).

240.

It is also mentioned by the witness that Goa has incorporated the concept of safe yield in the study and the 75% and 50% dependable annual safe yield in the entire Mandovi

812

River Basin is given as 1986.61 Mcum (70.10 tmc) and 2238.58 Mcum (79.06 tmc) respectively, by further reducing the catchment to 982 sq.km.

241.

Thereafter the witness has proceeded to mention the estimate made by Maharashtra in para 3.3(h) of his affidavit. The witness has stated that Mandovi River Basin is being gauged at Ganjim and Collem on Mahadayi and Khandepar tributaries of Mandovi river. The witness has stated that both these sites do not cover the catchment lying in Maharashtra Territory, and the Maharashtra State has established closer grid of rain gauge stations, as well as river gauging station, on its own in its catchment area lying in Mandovi basin. The witness further proceeds to state that the river gauging station in Mandovi basin part situated in Maharashtra has been located at Virdi downstream of confluence of Kattika Nalla and Haltar Nalla and is being gauged since 1986. The witness has further mentioned that Maharashtra has used this river gauging data and rainfall data of rain gauge stations established over last 20-25 years and

submitted this study as Document No. 97(a) - Annexure 23 on 26.11.2014. According to the witness, based on the regression analysis and co-relation developed between rainfall and runoff,

813

Maharashtra has estimated yield from its own catchment of 77 sq.kms., as 171.89 Mcum at 75% dependability and 200 Mcum at 50% dependability.

242.

The witness further proceeds to mention that Maharashtra has, however, neither estimated nor carried out any exercise to determine water availability in the entire Mandovi basin, but Maharashtra had participat ed in the CWC's study carried out in 2001 and 2002. The witness has mentioned that Maharashtra has supported CWC's study for consideration of the Tribunal vide Document (Volume 125) filed on 20.04.2015.

243.

In paragraph 3.4 of his affidavit, the witness has stated that based on the above review he had prepared a table showing the water availability estimated by various studies reported above to give the gist and the specific yield which indicates the per sq.km. availability in the catchment is also given in the statement to draw comparison. The table given by the witness is to be found on page 18 of his affidavit.

244.

The witness in paragraph 4 has mentioned about

water availability in Mandovi Basin. The witness has stated that

814

CWC as per the study report of March, 2003 has assessed the water availability of entire basin as 5652 Mcum at 75% dependability and 6234 Mcum at 50% dependability. According to the witness, he got the rainfall-runoff relationship derived by CWC, checked the same from his team and observed that the relationship is nearly the same and hence can be relied upon by the State of Maharashtra. The results of the study prepared by his team are enclosed by the witness as Annexure 1 to his affidavit.

245.

In para 4.3 of his affidavit the witness has stated that his study, however, does not account for import of water from Tillari basin to Mandovi basin and while estimating the water availability in basin, the imports of water from other basin or diversion of other basin to the basin under study has to be accounted for.

246.

What is emphasized by the witness is that as far as the State of Maharashtra and the State of Goa are concerned, he had

gone through the agreement between the State of Goa and the State of Maharashtra entered on 06.04.1990, whereby the State of Maharashtra has agreed to supply water to the State of Goa in

the ratio of 26.7 : 73.3 from Tillari River Basin. The witness has appended a copy of the agreement as Annexure 2 to his affidavit. The witness states that a part of this water is being utilized by the State of Goa in Mandovi basin for irrigation, domestic and industrial uses and the proportion of use in Mandovi basin has been assessed by NWDA in its Technical Study No. 93 of July, 1989 as 227.75 Mcum. The witness has informed in his affidavit that an understanding recently reached between Maharashtra and Goa has modified the quantum of water to be used.

247.

According to the averments made in paragraph 4.4 of his affidavit, in the 101 st meeting of the Technical Advisory Committee of Planning Commission, Government of India held on 30.11.2009, the Committee has accepted the revised proposal of Tillari Irrigation Project, a joint venture of Maharashtra and Goa States. The witness has mentioned that as per the revised planning utilization from Tillari Project would be 621.17 Mcum of which Maharashtra will use 161.49 and Goa will use 459.68 Mcum. What is stated by the witness in his affidavit is that the

State of Goa as per its revised planning has planned use of 348.215 Mcum for irrigation and 111.465 Mcum for domestic and industrial use. A copy of the summary record of TAC meeting

dated 30.11.2009 is produced by the witness as Annexure 3 to his affidavit. The witness has mentioned that part of this water being used in Mandovi basin of Goa needs to be assessed and accounted for while computing the availability of water in Mandovi Basin.

248.

In paragraph 4.6 of the affidavit it is emphasized that NWDA has already accounted for the import of water in the study as 228 Mcum and in the 101 st TAC meeting, State of Goa's utilization is planned as 459.68 Mcum out of which utilization of 261.33 Mcum is assessed as use in Mandovi Basin.

249.

During the course of Examination-in-Chief, the witness produced a Note on Planned Water Utilization of Goa State in Tillari (Chapora) and Mahadayi (Mandovi basin) with extract of pages from CWC Note on Tillari Project for consideration of Advisory Committee on Irrigation and Flood Control, November 2009 and extracts of the Note prepared by Government of Goa for visit of CWC Officers dated 15 to 19.11.2008 is enclosed by

the witness as Annexure 4 to his affidavit. The witness has mentioned that taking into account this water import, he has assessed the availability in Mandovi Basin as 5913 Mcum at 75%

dependability.

According to the witness, the KWDT, after allocating the water has accepted the principle of return flow after development of water use in phased manner and allocated the same and the same principle will be applicable in this case also. What is mentioned by the witness is that the use of water for irrigation and domestic use, approved by the Tribunal, will further generate return flows which would also be available for utilization and KWDT has considered such return flows as 10% from irrigation, 80% from domestic use and 97.5% from industrial use.

250.

In paragraph 5 of his affidavit the witness has dealt with water availability from Mandovi Basin part of Maharashtra State and has stated that as per IS 5477(Part-3):2002, about 40 years' data is desirable for hydrological estimation. The witness states that rainfall data which was not observed for the above station was estimated from 1969 onwards and weighted rainfall was derived by Chief Engineer, Planning and Hydrology, Nashik

and, accordingly, the report has given the water availability as 171.89 Mcum at 75% dependability and 200.01 Mcum at 50% dependability. The witness has further claimed that he has relied on the observed data available for the purpose of study and he

got the studies prepared afresh based on purely observed data for the purpose of estimation of water availability from Maharashtra area lying in Mandovi Basin. The witness further claims that he has prepared the table of actual runoff observed and recorded at Virdi site from 1986 onwards. According to the witness, he has observed from the recorded data that for the year 2005 the data was not recorded, because in this year very heavy incessant rainfall was experienced in Maharashtra and probably site being difficult to access, no record of gauge discharge during floods was kept. The witness claims that he looked into similar rainfall figures in past record of various rain gauge stations in catchment as well as Tillarwadi and observed that the situation is more or less parallel to year 1992 and hence for continuity of series assumed same runoff as of 1992. According to the witness, the assumption is on safer side as it will only marginally influence specific yield figure. The witness has further informed that the catchment area at Virdi R.G. site is 35.43 sq.km. and the actual observed data has been arranged in descending order to find out water availability at Average, 50%

and 75% dependability and the same is given as specific yield from Haltar Catchment as 3.40 Mcum/sq.km., 2.97 Mcum/sq.km and 2.39 Mcum/sq.km. The witness has produced detailed Note

on studies as Annexure 5 to his affidavit. What is mentioned by the witness is that a comparison of specific yield given in the table under para 3.4 reveals that CWC study shows specific yield of 2.78 Mcum/ Sq. Km. at 75% dependability and 3.07 Mcum/Sq. km. at 50% dependability which is in fair agreement with his computations. According to the witness he had looked into the figures of rainfall in Haltar Catchment vis-à-vis CWC study and observed that the rainfall as per CWC study is more than in Haltar Catchment and hence marginal increase in specific yield revealed by CWC study is justified. Conclusions of the study have been mentioned in paragraph 6 of his affidavit, which are as under:

“6.1 As stated in para 4 covering water availability in Mandovi basin, I consider 5913 Mcum as the water availability in entire Mandovi basin including import component as water availability plus return flows to be evaluated, as the water availability from Mandovi basin for allocation purposes.

6.2 Contribution to the Mandovi basin from Maharashtra’s portion is of the order of 184 and

262 Mcum at 75% and average dependability respectively which may be considered for allocation purpose.

6.3 Maharashtra vide its document no. 27 submitted on 2.1.2013 has dealt with the issue of

820

dependability in para 2.1.5 of this document and I, therefore, request this Hon'ble Tribunal to decide allocation at 75% dependability and average dependab ility."

251.

In the Note on Study about yield of Mahadayi River Basin carried out by Central Water Commission in March, 2003, EXH. MAH/MW1/1, the Gist of Yield Study carried out by HSO, CWC in March, 2003, is mentioned in paragraphs 1, 2 & 2.1 it is stated that this study was carried out with the help of following hydro meteorological data:

"i) The rainfall data for the 15 rain gauge stations located in and around the catchment area has been supplied by IMD, Pune.

ii) The observed runoff data observed at G&D site at Ganjim on Mahadayi river has been collected from the published CWC Water Year Books.

iii) The data for the upstream utilization in the catchment area of Ganjim gauging site."

252.

In

para

2.2

the

witness

has

explained

the

methodology adopted in the study. The computation of the yield made by CWC is mentioned in paragraph 2.6 of the Note and it is mentioned that the annual yield series for entire Mahadayi basin

was prepared for the period 1928-29 to 1997-98 i.e. for 70 years and the dependable flow figures with this yield series at 75% and 50% dependabilities are derived as 5652 Mcum (199 tmc) and 6234 Mcum (220 tmc) respectively.

253.

In paragraph 3 of the Note the witness has mentioned that the State of Goa was not fully satisfied with the hydro meteorological data considered in the study of CWC and the State of Goa was insisting on analyzing rainfall data including the period from 1901-1931 and that the State of Goa has reservations about the accuracy of flow data at CWC G&D site at Ganjim on Mahadayi river, but the State of Karnataka and the State of Maharashtra had no reservations about the study undertaken by CWC. According to the witness in view of reviewing the yield study carried out by HSO, CWC, the Karnataka assigned the studies on water availability assessment for the Mahadayi river basin to the Indian Institute of Science, Bangalore, and the study “Water Yield Estimates for the

Mahadayi River Basin Annual Regression, July 2011” to review the Rainfall-Runoff Model developed in the earlier yield study carried out by HSO, CWC in 2003. The IISc, Bangalore, with data set of monsoon catchment rainfall up to the Ganjim site and

monsoon flows at Ganjim site, has developed the relationship between monsoon catchment rainfall and runoff at Ganjim site as below:

“R = 0.6256*P + 1297

Where,

R = Annual Monsoon Runoff in mm

P = Annual monsoon catchment rainfall in mm ”

254.

In paragraph 5 of the Note it is stated that using the above mentioned relationship, IISc, Bangalore, has assessed the dependable flows of entire Mahadayi basin at 75% and 50% dependabilities and those are 6767 Mcum (238.98 tmc) and 7171 Mcum (253.24 tmc) respectively. The witness has mentioned in paragraph 5 of the Note that the rainfall-Runoff relationship developed by I.I.Sc, Bangalore (2011) is totally different from the relationship derived in the study of CWC (2003) in spite of using same rainfall and runoff data. As mentioned in paragraph 6 of the Note, the State of Goa approached the Indian Institute of

Technology, Bombay for developing rainfall-runoff relationship and thereby to estimate the water availability in Mahadayi Basin. In response to this, IITB carried out the study and prepared a report with caption as “Water Yield Studies for Mandovi River

Basin – a linear regression approach" and this report has been filed before the Tribunal by the State of Goa in December 2014.

255.

Paragraph 7 of the Note proceeds to mention that IITB has taken review of the yield studies of Mandovi river basin carried out so far by various authorities and institutions and in its view in case of CWC (2003) report on yield study of Mahadayi basin regarding Rainfall-Runoff relationship developed in CWC (2003) Report, IITB has also endorsed the remarks raised by I.I.Sc, Bangalore in its Annual Model Report. In the report, IITB has drawn its conclusion which is reported at para 7, page 31 of Volume 163(a) and the same is reproduced hereunder:

"… even though the data length and methodology adopted is same as that of CWC(2003) report, the developed regression equation is entirely different than the equation reported by CWC(2003), leading to different annual runoff values. *Wehave also cross verified the linear regression equation by developing a linear regression model for the same*

data given by CWC(2003) up to Ganjim site, and obtained the same equation as derived by the IISc. We were not able to get the equation derived by CWC. ”

824

256.

In paragraph 8, the witness has presented Review of Study by the State of Maharashtra and in paragraph 20 finally it is concluded that the yield figures assessed by HSO, CWC in the CWC (2003) report or now assessed by the State of Maharashtra are based on consistent hydro meteorological data and methodology best fit to the data available and the yield figures arrived at in CWC (2003) and in the review by Maharashtra are very well in agreement and hence the yield figures of either study can be considered for the yield of entire Mahadayi basin. The yield figures mentioned in paragraph 20 of the Note are as under:

Particulars	50% dependability	75% dependability
CWC(2003) Study	6234 Mcum	5652 Mcum
Review by Maharashtra	6206 Mcum	5627 Mcum

257.

A detailed Note on his study is enclosed by the witness as Annexure 5 to his affidavit. If one refers to Annexure

5, which is to be found at page 79 of the Affidavit, it becomes apparent that Chief Engineer, Planning and Hydrology, Nashik, had determined the water availability by developing composite yield series (Observed yield series + estimated yield series) with

825

the view to satisfy the requirement of IS 5477 (Part 3):2002 of minimum 40 years length of series for assessing water availability. In order to cross verify, the water availability assessed in the Chief Engineer, Planning and Hydrology, Nashik's report, it was decided to verify it with the estimation of water availability to be decided on the basis of annual observed data and for this the exercise indicated in paragraph 5.1, to be found on page 80 of the affidavit was undertaken.

258.

In paragraph 5.2 at page 81 the dependable flow figures and corresponding specific yield figures are reproduced which are as under:

Sr. No.	Exercise/study	Dependable yield figures in Mcum at different dependability (Specific yield in Mcum/sq.km.)		
		Average	50.00%	75.00%
1	Annual flow series on the basis of observed data with filling gap of one year 2005 (Proforma-A)	261.65 (3.398)	228.82 (2.971)	184.24 (2.392)

2	Annual flow series on the basis of only observed data without filling gap of one year 2005 (Proforma-B)	250.37 (3.251)	227.34 (2.952)	183.35 (2.381)
3	Chief Engineer, Planning and Hydrology, Nasik's report	201.26 (2.264)	200.006 (2.597)	171.891 (2.232)

826

259.

This witness was cross-examined by the learned Counsel for the State of Goa in detail and few questions were put to him by the Tribunal also. In answer to question no. 3, put by the learned Counsel for the State of Goa, the witness has stated that neither he nor his team had checked about the selection of the rainfall stations used for computing weighted rainfall at Ganjim. It was stated by him that the selection of the rain-fall stations used for computing weighted rainfall for entire catchment was also not checked by him or by his team. The witness had further stated that following factors were not checked either by him or by his team:-

a) The selection of the rainfall statins used for computing weighted rainfall at ganjim;

b) The selection of the rainfall stations used for computing weighted rainfall for entire catchment;

c) The drawing of Thiessen polygon at Ganjim;

d) The measurement of areas of Thiessen polygon at Ganjim;

e) The computation of Thiessen weights at Ganjim;

827

f) The drawing of Thiessen polygon for entire catchment;

g) The measurement of areas of Thiessen polygon for entire catchment;

h) The computation of Thiessen weights for entire catchment;

i) The adding of the daily rainfa ll data, from IMD's files, in order to obtain the monthly rainfall data;

j) The adding of the daily runoff data, from CWC's files, in order to obtain monthly runoff data;

k) The filling of the missing rainfall data;

l) The consistency checks applied to the rainfall data;

m)Any other checks applied to the rainfall data

n) The computation of the non-monsoon contribution;

p) The application of the regression equation to data prior to 1979, and, the preparation of estimated runoff series;

260.

In view of the above mentioned state of affairs, a

question was put to the witness as to whether the decision not to check the aspects mentioned in the aforesaid sub-paragraphs in the questions was taken by him or by his team or was it taken by

the State of Maharashtra and, if so, at what level. The witness replied that the decision was taken by him to ignore the aforesaid aspects mentioned in sub-paragraphs (a) to (n) and (p) of question No. 3. According to the witness, his approach in preparation of affidavit regarding water availability in the Mandovi basin was to look at the various studies carried out by different party-States and verify whether the reliance placed by Maharashtra on CWC was acceptable or otherwise and, therefore, he did not scrutinize CWC (2003) Report in detail. The attention of the witness was drawn to his study, wherein he had used the data at Ganjim discharge site up to the year 2005 and, therefore, a question was put to him as to why he had not used the data of Ganjim discharge site post the year 2005. The answer given by the witness was that he had not used the discharge data of Ganjim river gauging site up to the year 2005 and what he had done was checking of the correlation equation and applying the equation derived by him to the weighted rainfall given in CWC (2003) Report up to the year 2000, and since he had found IISc, Bangalore study had given weighted rain fall till 2005, he had just

computed the yield from this data and found that the same nearly matched with the 75% dependable yield estimated by CWC.

829

261.

A question was put to the witness as to whether the hydro-meteorological data submitted by the State of Karnataka before the Tribunal vide Volume 98, and the consistency analysis of flow data in Mahadayi basin conducted by CWC (Volume 99), was made available to him by the State of Maharashtra. To this question the answer of the witness was that he was not made available the aforesaid Volume 98 but Volume 99 was given to him.

262.

Attention of the witness was drawn to page no. 82 of his Report [Volume 163(a)], which is a Note on “Assessment of Water Availability in Maharashtra Catchment area in Mandovi Basin” and a question was asked as to whether before accepting this data he had subjected the said data to any checks. The answer given by the witness was that he had not checked this data himself, but a daily discharge data, which had been submitted before the Tribunal, as Annexure 25(H), Volume 113(a), had been used and got converted into monthly figures,

which were then checked by him.

830

263.

In question No. 19, put to the witness by the learned Counsel for the State of Goa, eleven discrepancies were pointed out to the witness in the so called CWC (2003) Report. After pointing out above stated gross errors, the learned cross-examiner had sought the opinion of the witness about errors. The witness responded by saying that he did not agree with the suggestion made in the said question to the effect that CWC(2003) Report was suffering from any gross errors. The fact that, according to the government of Goa, severe discrepancies outlined in question No. 19, were serious enough to affect the sustainability and credibility of the so called CWC(2003) Report, was pointed out to the witness and it was further stated by the learned cross-examiner that by placing reliance on the same in his studies, those very errors and discrepancies had also been carried over in his report and as such those had affected his study report, more so, because the witness had admitted in answer to question No. 18 that except the arithmetic of the R-R regression equation, he had not checked or verified any other thing in the

so called CWC (2003) Report. After pointing out the above mentioned relevant factors, the learned cross-examiner had sought the response from the witness.

The witness stated that he did not consider that the discrepancies were serious enough to the yield figure given in CWC Report and that his reliance was on the estimated yield figure. The witness explained that his reliance was not only on account of the regression equation but also on the basis of comparison of specific yields calculated by him on page 18 of his affidavit. According to the witness, the specific yield, on which he had relied upon, was based on comparison of adjoining basin Tillari, wherein the specific yield, which he had verified on the basis of river gauge data of Tilariwadi River Gauging Station from 1973 to 2002, maintained by the Chief Engineer, Hydrology Project, Nashik, Government of Maharashtra. The witness further stated that he had also a look at Volume No. II (Goa), which was a hard copy of CD at Annexure 120 in Volume 31 and Volume I to IV, which was a list of 61 projects in Mandvi River Basin in Goa State for water conservation and regulations for long term development and their salient features prepared by the Panel of Experts of the State of Goa, which indicated that the total catchment area worked out to be 998.93 sq.kms.

264.

In question No. 31 put to the witness, the errors committed by the witness in Columns Nos. 8 & 9 of Annexure 18

832

were brought to his notice and his response was sought. The witness stated that while reading columns nos. 8 & 9 of annexure 18, he had inadvertently misread the title of the aforesaid Columns and had also not looked at the individual projects, but considered the final total figures given in Annexure 18 for comparison.

265.

After the cross-examination by Shri Dattaprasad Lawande, learned Advocate General for the State of Goa was over, Shri Mohan V. Katarki, learned Counsel for the State of Karnataka, was requested to cross-examine the witness, but Shri Katarki had stated that he had no questions to ask from this witness.

266.

Thereafter certain questions were put to the witness by the Tribunal in order to elicit best information relating to the availability of water in Mahadayi basin. The attention of the witness was drawn to paragraph 1.2 on page 3 of his affidavit,

wherein he had stated that after his superannuation from service, the Government of Maharashtra had appointed him as an Advisor on the matter related to Krishna Water Disputes and for obtaining clearances to the various irrigation projects of

Maharashtra and till about 2010-11, he had got 40-50 projects cleared from Technical Advisor Committee of Planning Commission headed by Secretary, Ministry of Water Resources, Government of India. Therefore, four sub-questions were put to the witness by the Tribunal. The first question was as to for which specific period did he work as an Advisor to the Government of Maharashtra and the second question was whether any project of Maharashtra in the Mahadayi basin was also identified and included for obtaining clearance from the Technical Advisory Committee as well and whether the Detailed Project Report of Virdi Project was prepared and submitted to Central Water Commission for seeking the clearance of the Technical Advisory Committee and whether the cases for seeking other mandatory

clearances including that from the Union Ministry of Environment and Forests were also pursued by him.

267.

In answer to the above mentioned questions, the witness stated that he had been appointed as an Advisor initially for Krishna Water Disputes Tribunal from October, 2006 and thereafter, after constitution of Mahadayi Water Disputes Tribunal. According to him, technical clearance of any project from Mahadayi basin was not posed to the Technical Advisory

Committee till about 2010-11 and the Detailed Project Report of Virdi Project of Maharashtra was not submitted to Central Water Commission for seeking the clearance of the Technical Advisory Committee because Virdi Project was planned as a minor irrigation project. The witness further stated that for the projects from the State of Maharashtra, which were posed for technical clearance, for those projects, the Maharashtra Government had sought environment and forest clearance from time to time, which were pursued by him.

268.

In answer to question No. 12, posed by the Tribunal the witness mentioned that while preparing his affidavit, his approach was whether the reliance placed by the State of Maharashtra, on CWC (2003) Report was acceptable or not and, therefore, he had not gone into the detailed study to satisfy whether a simple linear equation was appropriate or otherwise. It was claimed by the witness that he had just used the data from CWC and checked whether the regression equation was in order or not and after deleting the inconsistent runoff factor figures, he

had verified the equation and since they were nearly the same, he concluded that Maharashtra's reliance on CWC (2003) Report was acceptable. He also admitted that he had not investigated

further details nor he had undertaken studies relating to validation of the regression model.

269.

A question was put to the witness as to whether he had assessed the quantum of utilizable water for the Mahadayi basin and, if so, what were his findings. Another question was put as to whether he had examined the salient features of the project proposed by the State of Karnataka in the Mahadayi basin and, if yes, what were his findings, particularly in respect of utilizable water. Another question put to the witness was as to whether he examined the salient features of the projects proposed by the State of Maharashtra in the Mahadayi basin and, if yes, what were his findings, particularly in respect of utilizable water.

In answer to the above stated questions, the witness stated that he did not assess the quantum of utilizable water for Mahadayi basin as his deposition was related to availability of the water in the basin and not related to utilization of available water. The witness further admitted that he had not examined the salient features of the projects proposed by the State of

Karnataka. As far as the State of Maharashtra was concerned, the witness answered that he had looked at the Master Plan and the

salient features of the projects for which report had been prepared and submitted before the Tribunal.

This is the sum and substance of the evidence of Shri S.N. Huddar (MW1).

Oral Evidence of AW-2 Shri Paresh Porob for the State of Goa

270.

Having discussed the evidence of four Hydrologists, examined by the three different States, the Tribunal now proposes to consider the evidence of other witnesses examined by the three States.

271.

Mr. Paresh Porob was examined as witness, AW-2, on behalf of the State of Goa, and he deposed on Wildlife and Forest in the State of Goa.

272.

In Paragraph 2 of his affidavit-in-evidence dated 11.11.2017, filed on 14.11.2017 (Volume 209), the witness has given his educational qualifications, expertise and job profile. The Witness has also stated that in the year 1999, he had worked on

a project on Documentation of Flora and Fauna of Sacred Grove

837

in Sattari Taluka funded by Darwin Initiative UK through Centre for Environment Education, Ahmedabad.

273.

The witness has further provided his experience in the field in Paragraph 3(d) and in Paragraphs 4 to 9 about his experience in the works related to Wildlife Conservation. In Paragraph 8, the witness has stated that, he has been associated with the Mahadayi Forest since 1989, and even before the said area was declared as a Wildlife Sanctuary.

274.

In paragraph 13 of his affidavit, the witness has referred to National Forest Policy 1988, and has stated that if proposed project for diversion of Madei River waters is allowed, it will be harmful to the ecology, and it will also adversely affect the Wildlife Sanctuaries and in general it will definitely defeat the principal aim of the National Forest Policy 1988.

275.

According to the witness, the International Union for Conservation of Nature has identified 531 Biodiverse areas in

India, as Key Biodiverse Areas and Bhagwan Mahaveer and Madei Wildlife Sanctuary have been listed in it. The witness states the criteria adopted for this identification are (i) Threatened

Biodiversity (ii) Geographically restricted (iii) Ecological integrity (iv) Biological processes and (v) Irreplaceability, which clearly shows that, both these Wildlife Sanctuaries of Goa are internationally recognised and are heritage sites of our country.

276.

The witness proceeds to mention that India has been known for its rich Biodiversity comprising of 91000 documented plants, and 45500 species of animals, in its ten biogeographic regions. The witness has averred that Western Ghats have been notified as Natural World Heritage site in the year 2012 with an area of 7953.15 sq.km., stretching from State of Maharashtra, Karnataka, Tamil Nadu and Goa, having a distance of 1600 kms. The witness states that the entire stretch of Western Ghats from North Goa to South Goa, is under the protected area network, which has provided, a corridor for safe movement of Wildlife especially, Macro Fauna like Tigers, Gaurs, Sloth Bears, wild Dogs and Sambhars.

277.

According to him, he has photographed much of the rich

biodiversity present in the forest of Western Ghats in the State of Goa, and has produced those photographs as Annexure-A to his affidavit. According to the witness, by declaration of Wildlife

839

Sanctuaries and National Parks in Western Ghats of Goa, the State of Goa has, set a perfect example of Gene Pool Conservation, a concept of an age old traditional practice of Sacred Grove in India.

278.

The witness has mentioned that Madei Wildlife Sanctuary is the northern most Wildlife Sanctuary in the protected area, having an area of 208 sq.km. spread over the entire Taluka of Sattari and is notified as a Sanctuary on 31 st May 1999, under Section 18 and 26 of Wildlife Protection Act 1972.

279.

The witness proceeds to state that for better Wildlife Sanctuary, he has categorized the said Sanctuary into two major zones namely: (a) Hilly Tracts; and (b) Valleys.

280.

He has mentioned that out of ten valleys, only two Valleys namely Surla Valley and Codval Valley, have perennial stream in the form of Surla Stream in Surla Valley and Mahadayi River in Kodval Valley and he has categorized both the Rivers into

three Zones for better understanding of river ecology. The three zones are mentioned in detail by the witness in paragraph 26 and

another paragraph which is also numbered as para 26, and Para 27 of his affidavit.

281.

In para 32, the witness has emphasised that any change in vegetation diversity will result in drastic change in diversity of lower life forms like insects, as many species of insects, require a host of plant to breed to complete its life cycle. In paragraph 33, 34, 35, 36, 38, 39 etc., the witness has mentioned as to how the Wildlife would be affected if diversion of water, as claimed by the State of Karnataka is granted. The witness has also referred to Khazan lands and stated that the diversion of water would make them unproductive, affecting thousands of people depending on the Khazan lands. The witness has further made reference to man-animal conflicts which may have an adverse effect on account of reduction of waters. The witness has mentioned that, the balance in aquatic system will be greatly affected, and vegetation type along with the river banks would also be changed drastically.

282.

According to the witness there will be reduction in

water velocity, resulting in transportation of organic matter and

its deposition. Ill effects of the diversion of water are also detailed in Para 58 of his affidavit.

283.

This witness has filed additional affidavit-of-evidence dated 17.11.2017 on 20.11.2017 (Volume 214). The witness has produced a book titled “Biodiversity Profile of Goa” as Annexure - B to this affidavit, whereas the National Forest Policy of 1988 is produced by the witness as Annexure-C to his affidavit. The witness has further stated that he has relied upon International Union for Conservation of Nature, which has identified the Sanctuaries as Key Biodiversity areas,

whereas the National

Biodiversity Action Plan is produced by the witness as Annexure-E to his affidavit. The witness has further produced a scientific paper which showcases the unique eco-system in the Western Ghats, as Annexure-F, to his testimony, and has produced a document titled “Important Bird Areas (IBA)” a s Annexure-G to his affidavit. The witness has also produced a scientific paper “A Conservation Status of Survey of hornbills (Bucerotidae) in the

Western Ghats, India” published in I ndian Birds Volume 5, No. 4 as Annexure ‘H’ to his affidavit.

842

284.

The witness has stated that in so far as Forest Management is concerned, 50 Mcum is said to be the requirement, which is as per the Master Plan of Madei basin of May 1999 (in Volume 62 C, Annexure 120, Volume-I), prepared by the Panel of Experts. After reproducing paragraph 5.5.0 on page 53 of the said Annexure, the witness proceeds, to state that the Wildlife sanctuaries have a completely different requirements of their own, and the figure 50 Mcum excludes the water requirement of Wildlife in Madei Wildlife Sanctuary. According to the witness, the total area of catchment of Surla and Mahadayi stem rivers is, 75 sq.km. and 206 sq.km. respectively. The water requirement for Madei Wildlife

Sanctuary, is shown, in Table 1.1 which is reproduced below.

Type of Requirement	Surla River (In MCM)	Madei Stem (In MCM)
Domestic requirement	0.325	22.521
Livestock consumption	0.05	3.38
Irrigation	79.92	1162.43
Environment flow	124.51	411.20

(Source: Water balance Study by Mr. S.T.

Nadkarni Chief Engineer Water Resource

Department, Government of Goa)

843

285.

The paper titled “Impact of Dams and Riparian Frog Communities in the Southern Western Ghats, India”, by Rohit Naniwadekar, from Nature Conservation Foundation Mysore, and Karthikeyan Vasudevan from Laboratory for conservation of endangered species, is produced by the witness as Annexure-I to his affidavit to support his statement that reduction in any amount of water will result in drying up of eggs due to lack of moisture, which will in turn disturb the life cycle process of this frog species.

286.

The witness has reproduced Table No.1.2 on page 8 of his additional affidavit, which shows the different species of Amphibians, and has proceeded to mention that having regard to the fact that the Wildlife population is on an increase and is likely to increase in the near future, there are plans to increase the water holes and to create more water bodies within the Sanctuary and any depletion of flow of water in the river, will reduce its level and consequently, the quantum of flow, will

completely affect the entire Wildlife Sanctuary. The witness has referred to three unique types of eco-systems found in the Western Ghats which are referred to as Myristica Swamps and

844

has stated that they require inundation of water throughout the year and any reduction in the water of Madei river will result in threatening of these unique eco systems and the Fauna therein. It is also mentioned by the witness that the proposed diversion will reduce the flow of water in river Medei and as a result of this, there will be complete drastic and adverse effect on the ecology as well as on the precious Hotspot of Biodiversity.

287.

Further, the witness has placed reliance on Table 1.5 prepared by him, Exh. Goa-AW-2/3 (Volume 214) at pages 100 to 103 with input from Water Resources Department, Govt. of Goa, which inter-alia, indicates, the proposed project of river diversion, showing quantum of water to be diverted from upstream of wildlife sanctuaries.

288.

Mr. Porob has also specifically pointed out that while water fed through the river is plenty during the monsoon season, as the monsoon progressively approaches, the animals come to rely more frequently on the watering hole, across the Wildlife

Sanctuary and Parks. He has mentioned that, as the watering holes start drying towards the end of pre-monsoon cycle of the next year, they are again refilled, with the onset of monsoon and

increases the flow of the rivers. According to him, if there is abstraction/diversion of water, the availability of water will become scare for all animals, thereby adversely affecting their population.

289.

Mr. Porob, has mentioned that, the total 17 water holes have been established in Madei Wildlife Sanctuary, which are fed by the water coming from river Madei, during summer. The total quantum of water, in these water holes, are shown by him in Table 1.3 at page 15 of Volume 214. The same reads as under:-

FOREST	PRESENT WATER HOLES AND QUANTITY OF WATER	WATERHOLES AND THEIR QUANTITY ENVISAGED BY 2050
Madei Wildlife Sanctuary	17 (17x300 = 5100 Cum)	4 0 (40x300=12000 Cum)
Bhagwan Mahavir Wildlife	13 (13x300=3900	48 (48x300=14400

Sanctuary	Cum)	Cum)
Bondla Wildlife Sanctuary	8 (8x300=2400 Cum)	8 (8x300=2400 Cum)
Total	11400 Cum	28800 Cum

846

Similarly Shri Porob has also estimated the water requirements for the nurseries in respect of Mhadei Wild Life Sanctuary and Bhagwan Mahavir Wild Life Sanctuary and details are provided in table 1.4 at page 17 of Volume 214.

290.

This witness was cross examined by the learned Counsel for State of Karnataka. In response to question No.3, as to whether the witness has conducted any scientific study on the quantification of water requirement and forest, flora and fauna and the water requirements of villages in Surla valley and Kodval valley, the witness has answered that as a wildlife manager of the Madei Wildlife Century, efforts were made to scientifically manage the sanctuary, and in the process, scientific observations were made and recorded depending on which prescription for wildlife management is done. He further stated that scientific data base was relied upon from various studies carried out by researchers from various institutes. In respect of details provided in the additional affidavit dated 17.11.2017, the learned Counsel for the State of Karnataka put the question No. 14 wherein he

pointed out that the witness has mentioned the quantity of water required in Table 1.1 as 1804.336 Mcum (63.72 tmc), in

847

Table 1.3 as 28,800 Cum (0.001 tmc) and in Table 1.4 as 1,20,000 Cum (0.004 tmc) totaling 63.725 tmc, but no record in support of the calculations is disclosed. Therefore, the learned Counsel put to the witness that these self-serving calculations are ipse-dixit, without any record of scientific study and wanted to know the response of the witness.

In answer, the witness denied the suggestion. According to him calculations given in the tables 1.1 and 1.4 were taken from Water Resources Department of the Sate of Goa, whereas the scientific observations made by him, on day-to-day basis, on inventory of amphibian fauna of Surla and Codval Valley, were recorded to understand the existence and dependability of this Fauna in Madei Wildlife Sanctuary.

The witness had further

stated that reduction of any amount of water, in both the valleys will result in endangering and extinction of local species of frogs known as Nyctribatricus.

291.

The learned Cross Examiner for the State of Karnataka

requested the witness to refer to Volume-I of the Master Plan of Mahadayi/Mandovi river prepared by the Irrigation Department of Government of Goa and turn to page 55 and informed the

witness that in para 5.6.4, the requirement of water for different uses in Mahadayi Basin upto 2050 and are calculated and at serial No. 4, 50 Mcum (1.765 tmc) is mentioned against forest management, whereas in additional affidavit, the witness has claimed that, the water requirement of 0.001 tmc in table No.1.3 and 0.004 tmc in Table No.1.4, are required.

Further his

attention was drawn to the Master Plan, wherein it is mentioned that 158 Mcum (5.579 tmc) is required for salinity control, and thus the total water requirement for forest management, comes to about 7.344 tmc. Therefore it was put to the witness that if this quantification of water requirement of 7.344 tmc were to be maintained or ensured for meeting the forest management and salinity control, there would not be any adverse impact or damage to the environment and ecology in India. After putting the aforesaid suggestion the response of the witness was sought. The witness denied the suggestion and stated that the quantity mentioned in the Master Plan at page 55 para 5.6.4, referred to in the question, is for forest management at serial

No.4, and it should be noted that while preparation of Master Plan, forests are taken into consideration, since Madei Wildlife Sanctuary was not notified at that point of time, the

requirements of water for Wild Life and habitat maintenance, was not considered. The witness further explained that Tables 1.1 and 1.3 mentioned in his additional affidavit, show the quantum required directly by forest components of Wildlife Sanctuary.

292.

The attention of the witness was drawn to para 33 of his affidavit dated 11.11.2017 (Volume 209) and it was put to the witness that on the one hand he has stated that the Madei Wildlife Sanctuary has threatened species of birds, and on the other, the very document relied upon by him clearly shows that main threat to the bird heritage and flora and fauna in the Madei Wildlife Sanctuary, is human encroachment and mining, and therefore, the witness has selectively relied upon the article to show the proposed diversions of the Karnataka Government, which are likely to impact, on the forest of Mahadayi valley, but conveniently he has not adverted to, the preceding part of the article.

After putting the suggestions, the response of the

witness was sought by the learned Cross Examiner on behalf of Karnataka

850

The witness, first of all, denied the suggestions and stated that it should be noted that there is no mining activity within the jurisdiction of Wildlife Sanctuary in Goa and hence effect of any such mining activity on avifauna in Wildlife Sanctuary is not there at all, whereas river diversion projects are upstream of Wildlife Sanctuaries in Goa and also on upper stream of Bhimgarh Wildlife Sanctuary of Karnataka, which act as a wildlife corridor for unhampered movement of macro-fauna. The witness has asserted that any activity in upper stream, will result in disturbance to the habitat of avifauna and Gene-Pool conservation will be, greatly affected.

293.

Thereafter, Shri Mohan V. Katarki, the learned Counsel for State of Karnataka closed his cross-examination. Therefore, Shri D.M. Nargolkar, the learned Counsel for State of Maharashtra was requested to cross-examine the witness on behalf of the State of Maharashtra. In all the learned Counsel had put six questions to the witness, and question No. 6 was as to whether the witness agreed that any sort of diversion or

utilization by any of the States, including the State of Goa, in future, in Mahadayi Basin, would result in adverse impact and

would disturb the ecological balance, resulting in total disaster in Mahadayi Basin.

The witness stated that he agreed with what was stated in question No. 6.

294.

After the cross-examination of the witness, by the State of Karnataka was over, Shri Atmaram N.S. Nadkarni, the learned Senior Counsel for State of Goa stated that he did not want any opportunity to conduct any re-examination of this witness. Therefore certain questions were put to the witness by the Tribunal to elicit certain information relating to Wildlife etc. The attention of the witness was drawn to what he had stated in para 13 on page 10 of his affidavit dated 11.11.2017, and the attention of the witness was also drawn to MARK-GOA/16 (Colly.), as well as National Forest Report 1988, and witness was requested to inform the Tribunal as to whether he had examined the social and environmental costs and benefits, before arriving at the conclusion that if proposed project for diversion of Madei river water was allowed, it will be harmful to the ecology, and

that it will also adversely affect the Wildlife Sanctuaries and in

general defeat the principal aim of the National Forest Policy 1988.

In response, the witness stated that the Government of Goa has notified Forest Wildlife Sanctuary along the stretch of Western Ghats of Goa, for water security and maintaining ecological balance.

According to the witness socio-economic conditions of the inhabitants of these areas are depending on the Western Ghats in Goa, and in his earlier affidavit dated 11.11.2017 at para 46 on page 27 he had stated about man animal conflict and its implications on the socio-economic conditions of the people.

The witness proceeded to state that the water flowing out from Wildlife sanctuary is being utilised by people for cultivating which is a traditional practice and that is mentioned by him in para 55 on page 31 of his affidavit dated 11.11.2017.

295.

The attention of the witness was drawn to para 4.4.1 of

the National Forest Policy 1988, and witness was asked as to whether any forest land been diverted from any non-forest purpose, either by the State of Goa or by the State of Karnataka. Another question which was asked was as to whether the

853

diversion of forest land for non-forest purposes had resulted in any change, either increase or decrease, in the water availability, and how many projects related to dams and reservoirs, mining and industrial development, and expansion of agriculture, have been constructed in forest areas and how the availability of water has been impacted, as well the result of implementation of such projects.

The witness answered that he was not knowing if the States of Karnataka and Goa have diverted any forest land for non-forest purposes. The witness further stated that he did not know as to whether the diversion of any forest land for non-forest purpose has resulted in any change in the water availability, and finally he replied that he was not knowing about any project relating to dams, reservoirs, mining, industrial development and expansion of agriculture having been undertaken in the forest area, and therefore, he was not able to comment upon the impact of any such projects on the availability of water.

296.

It was brought to the notice of the witness that in

several paras of his affidavit dated 11.11.2017, he has mentioned about adverse impact of diversion of water from Mahadayi Basin

on forest and Wildlife, and his particular attention was drawn to para 54 on page 31 of his affidavit. He was informed that the Tribunal has noticed that the mean of the average monsoon rainfall over the Mahadayi Basin during the years from 1964 to 2005 is 3760.1 MM, and the average monsoon rainfall over the Basin, varies considerably. It was also noticed by the Tribunal that in many years there were considerable variations, in the yield with respect to yield mentioned for in the previous years, whereas there were marked variations in long term as well. Therefore the witness was asked as to whether he had examined the impact of variations in rainfall and consequently in yield from Basin, particularly when the variations were too large, as in the year 1971 and 1972, on the forest and Wildlife. Another question put to the witness was as to how he predicted disaster for the forest and Wildlife because of likely diversion of relatively small fraction of total yield of the Basin.

The witness mentioned that he is not a Hydrologist and therefore is not in a position to answer the first question. The witness proceeded to state that as far as forest and wild-life is

concerned, any diversion of water coming to the forest will still result in reduction of water and will also reduce water velocity,

which in turn, will harm dissolving of minerals and transportation of organic matter from one area to another and that this has been explained in detail, in para 26 on pages 16, 17 and 18 of his affidavit dated 11.11.2017.

297.

The Tribunal finds that the veracity/ authenticity of the figures relied upon by the Water Resources Department, State of Goa, having not been questioned/challenged or discredited by the learned Counsel for the States of Karnataka and Maharashtra, the reliance of Mr. Porob, on such figures may, therefore, be taken, as correct, for the purpose of his statements. It is pertinent to note that, in answer to question No.3 put by the Tribunal, the witness has stated that, while preparing his affidavit, he had taken into consideration, provisions mentioned in National Forest Policy, 1988, and the Tribunal finds that, the various aspects mentioned in National Forest Policy, 1988, were taken into consideration by this witness with reference to ecology or the developmental requirements, to be maintained in the States of Karnataka and Maharashtra.

298.

In view of the above discussions, the Tribunal concludes that the testimony of this witness, can be acted upon, subject to

856

availability of changes in quantum related information, in other witness's statements/submissions, put forth, on behalf of the State of Goa.

This is the sum and substance of the evidence of witness Mr. Paresh Porob (AW-2).

Oral Evidence of AW-3 Dr. Shamila Monteiro for the State Of Goa

299.

Having discussed the evidence led by Shri Paresh Porob, the Tribunal now proposes to discuss the evidence led by Dr. Shamila Monteiro. Dr. Monteiro tendered her Affidavit-in-Evidence dated 11.11.2017 as AW-3, and filed the same on 14.11.2017 (Volume 210).

300.

She has filed her affidavit on aspects relating to Mahadayi basin and also on aspects relating to the adverse consequences, which would ensue in case the proposed water diversion plans of the States of Karnataka and Maharashtra are given effect to.

857

301.

In paragraphs 2, 3 and 4 of her affidavit, the witness has mentioned about her educational qualifications, expertise and job profile.

302.

In paragraph 5 of her affidavit she has stated that coastal waters are recipient of (a) fresh water as well as, (b) terrestrial derived materials of lithogenic, pedogenic and anthropogenic origin, primarily brought in through river discharge and deposited along the continental shelves and in ocean basins. According to her, the rivers are major sources of organic matters to the coastal environment as they transport organic matter derived from vascular plants and soils through discharge, and terrestrial organic matters, derived from continental land masses is one of the major energy sources, to aquatic and marine organisms.

303.

After emphasizing the importance of benthic-pelagic coupling, the witness has stated that, Mahadayi river system is

divided into two major ecosystems i.e. a complete Fresh Water ecosystem from the source up to Ganjim and estuarine ecosystem from Ganjim up to the mouth of the river. The witness has mentioned that, Mandovi and Zuari Rivers are two major

water bodies of Goa, draining about 2523 sq. km., corresponding to about 75% of the total geographic area of Goa. The witness has stated that, Mandovi and Zuari estuary are tidal estuaries, interlinked by the Cumbarjua Canal and the freshwater river flow dominates both estuaries during monsoon, whereas the tidal flow dominates during the non- monsoon period.

304.

The witness has informed in paragraph 19 of her affidavit that Mahadayi River is entirely rain-fed and the discharge is highly seasonal in nature. According to her, about 90% of the rainfall in the Mandovi basin occurs, during the summer monsoon, with negligible rainfall during December to April. The witness has proceeded to mention that, the hydrographic conditions, in Mandovi estuary are, significantly different during the dry and wet season and that the Mandovi estuary and its backwaters in the hinterland are governed by mixed tides, with semi-diurnal dominance, whereas seawater intrusion is regularly measured up to 46 km. upstream near Ganjim. The witness has informed through her affidavit that,

mixing of sea water and freshwater, and consequently the production of various gradients of physico-chemical parameters has resulted in a manifestation of a unique, fragile, biologically

859

complex and highly sensitive ecosystems, with associated ecotones that act as a link between the marine and terrestrial ecosystem. It is also mentioned by the witness that the unique combination of freshwater and seawater balances the salinity levels and helps the highly specialized ecosystem from a complex food web comprising

primary producers, consumers and

decomposers, that maintains and sustains, the aquatic fauna, as part of the inextricable food web.

305.

In paragraph 30 of her affidavit, the witness has stated that, Mandovi and Zuari estuarine complex has a substantial cover of mangrove forest covering about 2000 Ha, and supports a complex food web, and the total area of mangroves supported, by the Mahadayi River and Cumabarjua, is spread over about 900 Ha. According to the witness, the Mandovi river is associated with about 60% forest cover.

306.

In paragraph 31, she has given particulars about

aquatic organism whereas in paragraph 32 of her affidavit the witness has mentioned about brackish water species. Further, in para 33 of her affidavit, various varieties of shrimps, prawns, crabs, etc. present in the brackish water of Mahadayi river are

860

mentioned, whereas in paragraph 34, particulars about bivalves are stated.

307.

It is mentioned by the witness that Mandovi estuary serves as a critical habitat for many migratory species and serves as a corridor for migration from freshwater to seawater and vice versa. After mentioning that Western Ghats, is now considered as one of the eight “hottest hot spots” of the world, the witness has stated that the Western Ghats, is extremely rich in faunal, floral and fungal diversity with more than 290 species of freshwater fishes. The particulars about freshwater fish species are mentioned by the witness in paragraph 38 of her affidavit and the witness has stated that reduced flow in the Mahadayi basin may alter/reduce biodiversity. According to her, any of the above mentioned perturbation would reduce inflow of freshwater, thus reducing the freshwater levels and there will be an increase in salinity concentration from 0.5 ppt to 2.9 ppt at any location in the estuary, which will lead to changes in water physico-chemistry. The witness has further pointed out that marine fishes

prefer to breed in waters having salinity less than 26 ppt and an increase in salinity is likely to decrease the ichthyoplankton population which will be reflected as a reduced fishery resource.

861

According to the witness, an increase in salinity will affect the potamodromous migration of freshwater fish, increasing the probability of extinction of some of the already endangered/critically endangered, freshwater fish species. The witness has stated that the reduced flow in the Mahadayi basin will have an impact on the river water quality, such as, increase in salinity, temperature, decrease in oxygen level, increase in turbidity levels etc. which would lead to a sluggish environment which in turn, would support and enhance growth of aquatic weeds and pests, due to which aquatic organisms, such as, fish, invertebrates and other aquatic fauna will be adversely affected.

308.

She has stated that there are about 30,225 fishermen in the State of Goa out of which 11,944 are active fishermen, and additionally, there are about 1,82,821 fisher folk, engaged in allied fishing activities including marketing of fish, processing, net mending and other ancillary work and who are totally dependent on fishing and its allied activities for economic sustenance and thus any change/diversion in the water will directly affect their livelihood, in turn having a negative effect on the local economy.

862

309.

According to Dr. Monteiro, the abstraction/diversion of water by the State of Karnataka will severely impact the survival of these fish, both for the purpose of maintenance of natural habitats, and also on the livelihood of local consumption of fish by the local population, especially in the villages surrounding these regions. Dr. Monteiro has categorically stated that the consumption of fish by the local population in Goa is higher than the national average, so as to signify the importance and relevance of the fish in daily diet habits of the local population.

310.

Having stated that the coastal waters of Goa are highly influenced by the Mahadayi River System, it is stated that as it eventually drains into the Arabian Sea, the water makes the coastal waters a nutrient rich fishing zone. What is mentioned by the witness is that the survival of Western Ghats and the continuity of fresh water flow are essential to sustain the rich aquatic biodiversity, which is vital.

311.

The witness has filed her additional Affidavit-in-Evidence on 17.11.2017 (Volume 215). In paragraph 3 of the additional affidavit, the witness has mentioned that she had

conducted a study on the biodiversity of the fish along the fish landing centers of North Goa from January, 2014 to April, 2014 and that she had identified a total of 134 varieties of fish and 24 varieties of crustaceans and 12 moll scans and included the study area of Mahadayi estuary. The witness has produced her study as Annexure-A to her affidavit. According to her, she had also conducted a study on the fresh water fish biodiversity of Goa and had identified 46 freshwater species. The study carried out from May, 2014 to August 2014, by the witness is produced by her as Annexure-B to her this affidavit. The witness further claims in paragraphs 5 of her additional affidavit that she had conducted a study on the effect of salinity on the growth of Catla and Labeo rohita during the months of July to October 2003 at the brackish water fish farm of the Fisheries Department. The study is produced by her as Annexure-C to her additional affidavit. As stated in paragraph 6 of her additional affidavit, the witness had calculated the quantum of water required for maintaining the fisheries biodiversity during the wet season and dry season based on the Tennant method and, accordingly, in order to maintain

the fisheries biodiversity in the present condition, the quantum of water required is 104.928 tmc during the wet season and 1.752 tmc during the dry season. The witness has further stated

that an amount of 52.464 tmc is required during the wet season and 0.876 tmc during the dry season, to maintain the fisheries biodiversity in a moderate condition.

312.

In paragraph 7 of additional affidavit, the witness has stated that the average fish catch in the Mahadayi estuary was estimated to be 71046 kg. in the dry season and in the wet season 108485.67 kg. in the year 2016, and therefore, it is stated that the production of fish in an estuary is directly dependent upon the fresh water flow coming in the estuary. The witness has asserted that reduction of this flow during the monsoon season would directly affect the production of the fish and if 23 tmc water is diverted, considering that the total yield of the Mahadayi basin, as per the yield submitted by the State of Goa is 113.5 tmc the aforesaid 23 tmc constitutes almost 20.35% of the total reduction in flow which will drastically and adversely affect the biodiversity of fisheries and also reduce the fish production, apart from causing serious prejudice to marine resources and

sustainability of the ecosystem.

313.

What is asserted in paragraph 8 of her additional

affidavit is that the abstraction and diversion of 20.13 tmc by the

865

State of Karnataka, and 2.83 tmc by the State of Maharashtra will change the natural flow of the river, affecting the fisheries biodiversity and aquatic habitat, and hence not ecologically sound.

314.

The witness has mentioned that she had relied on work done by NIO published as scientific papers in scientific journals which are annexed as Annexure-D to her additional affidavit and she has also stated that she had relied on Salinity ingress data based on the DHI report submitted as Annexure-F [Volume 150(a)] Final Report Volume-1, page No. 62.

This is the sum and substance of the evidence of Dr. Shamila Monteiro (AW-3).

Oral Evidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

315.

Having discussed the evidence tendered by Dr. Shamila Monteiro, Director, Directorate of Fisheries, Government of Goa, the Tribunal now proposes to examine the evidence

adduced by Shri Rajendra P. Kerkar, Environmentalist on

environmental matters, who has been examined by the State of Goa as AW-4.

316.

This witness has tendered his Affidavit-in-evidence dated 11.11.2017 filed on 14.11.2017 (Volume 211). The witness has stated that he is presently working for the awareness of environment, wildlife and forest related issues in the State of Goa and border areas, since the period of the last more than a quarter century. He has further stated that he has filed his Affidavit in order to depose and prove the facts as regards Forest, Flora and Fauna, present in the Mhadei Wildlife Sanctuary, as well the entire drainage areas of Mahadayi River Basin in Karnataka, Maharashtra and Goa. In paragraph 3 of his Affidavit, the witness mentions about his educational qualifications, experience and job profile. The witness has stated that Biophelia Hypothesis suggests that human possesses an innate tendency to seek connection with nature and other forms of life. According to him, his efforts and activities to protect the environment around him had been always without any profit motives or

without any hidden agenda and that in the said process, many times, he had to criticize the action of several agencies in Goa, Karnataka and Maharashtra States, but in spite of it, Government

of Goa sought his participation in the current proceedings as a witness, which is nothing but a glaring testimony of the right direction, truth and dedication of his actions. After stating that, he had visited the site, where construction work pertaining to the inter-connecting channels at Kankumbi was done by the State of Karnataka Neervari Nigam Ltd., Shri Kerkar informed the Tribunal that the same has been designed for diverting the flow of water from Kalasa Nala and its tributaries to Malaprabha River. According to the witness, he was, and has been monitoring the said work right from the project's foundation stone laying ceremony, which was held on 2nd October, 2006, till date and it has come to his knowledge through information obtained through several RTI Applications filed by him that the State of Karnataka has not obtained any necessary statutory permission and necessary clearances under Environmental Protection Act, Forest Clearance Act and Wildlife Protection Act, but has brazenly continued with the environmentally degrading construction of the inter-connecting channels at Kankumbi till Mid June, 2017, and this construction has resulted in large scale destruction to

the environment. According to the witness, there is absolutely no proper environmental impact assessment study, undertaken by the State of Karnataka, before embarking on the construction of

such a large scale project and undisputedly on account of work already carried out, an extremely large forest cover area is destroyed on account of felling of trees. The witness has proceeded to state that on account of excavation works, and other works carried out by the State of Karnataka at the Mauli temple site, there has been damage to the said temple.

317.

The witness has claimed that he had tried to educate himself with the pleadings, studies, submissions, applications, claim statements, replies and various reports submitted by other experts before the Tribunal, including the issues framed by the Tribunal, and that he proposes to present himself as a witness on the basis of his personal experiences and knowledge, that he gained as a physical explorer, of not only the basin area of the Mahadayi basin, but other areas of the Western Ghats, ethically and without any prejudices. In paragraph 14 of his Affidavit, the witness has mentioned that there was lack of base or preliminary information required for advancing scientific exploration of the Western Ghats region of Goa vis-à-vis its biodiversity. After

quoting some portion from a document, named “Current Ecological Status and Identification of Potential Ecology Sensitive Areas in the Northern Western Ghats” published by Ministry of

Environment and Forests, the witness has produced the relevant page of the said study as Annexure-II to his Affidavit. According to the witness by reading a technical paper published by the scientists of Indian Institute of Sciences, Bangalore, it is evident that Myristica swamps forest for many rare species diversity, not only in floral diversity, but also faunal assemblages bio-diversity, which modem ecological science can seldom ignore. A part of the study is produced by the witness as Annexure-VI to his Affidavit. The witness has referred to a study prepared by the Institute of Environment Education and Research, Bharti Vidyapeeth, Pune, and stated that the Western Ghats are the most important distribution range for many plants at family and generic levels which have extremely restricted distributions. A partial list of threatened Flora and Fauna in various locations in Northern-Western Ghats, along with critically endangered, vulnerable and near threatened species list, as mentioned in the said study, is referred to by the witness, and the witness has identified all biological species living in a particular defined area as given in all bio-diversity inventory project, as Annexure-VII of his Affidavit.

The witness has asserted that the place where Karnataka Government had undertaken the work of Kalasa canal in Kankumbi has been identified as Ecologically Sensitive areas by

Western Ghat Ecology Expert Panel, which was re-affirmed as Ecologically Sensitive areas by the High Level Committee appointed under the Chairmanship of Dr. Kasturirangan. The witnes s has proceeded to state that without caring for Goa's concerns, both Karnataka and Maharashtra were surveying, planning and undertaking projects in the Mahadayi basin, unilaterally, even when the case was being argued before the Tribunal and the State of Karnataka had also drawn plans for diversion of Dudhsagar waters, a cruel decision that tantamount to disappearance of the heritage site existing from much before the formation of the Himalayas. The witness has stated that out of the nine rivers and its several tributaries, the river Mandovi is the only one that fulfills the needs of maximum requirement of water for the State of Goa, whereas the rest of the rivers have high level of salt water intrusion. It is mentioned by the witness that both neighbouring States of Maharashtra and Karnataka where the sources of major rivers and tributaries lie, have not understood the impact of sea level rise leading to salination of Goa's surface and ground water resources. The witness has

quoted a research paper published by one reputed scientist of National Institute of Oceanography on the subject Estimation of Flushing Time in a Monsoonal Estuary, using observational and

numerical approaches, and has stated that the plan of upstream diversions during monsoon by upper riparian State of Karnataka and Maharashtra are, if implemented, the total flushing time will drastically increase, deteriorating the health of the estuary with irreversible consequences and this aspect has not been covered in the cited DHI Report. The witness further states that quantifying the environmental flow, presents a formidable problem. The witness has, in detail, mentioned about the environmental management classes in detail in paragraph 38 onwards. Thereafter, the witness has made four specific recommendations, which are to be found on pages 39 and 40 and based on four recommendations, the witness has made fifth recommendation in respect of the water requirement for environmental flow which is as under:

Preferred			
Basin/Sub Basin	Annual, 36.8% of MAF	E.F (non-monsoon)	E.F. (Monsoon)
Assnora	35.8	1.32	34.5

Bicholi	87.1	3.40	83.7
Valvanti	89.1	3.48	85.6
Kudne	32.8	1.25	31.5
Kotrachi	102.2	3.55	98.7
Khandepar	339.2	13.00	326.2
Ragda	195.9	7.53	188.4
Surla	124.5	4.21	120.3
Siquerim	0.0	0	0.0
Main Mahadayi	411.2	52.0	359.2
Total MCM	1417.8	89.8	1328.0

TMC	50.1	3.2	46.9
Not Less Than			
Basin/Sub-Basin	Annual, 21% of MAF in MCM	Non-monsoon	Monsoon
1	2	3	4
Assnora	20.4	1.32	19.1
Bicholi	49.7	3.40	46.3
Valvanti	50.8	3.48	47.3
Kudne	18.7	1.25	17.5
Kotrachi	58.3	3.55	54.8
Khandepar	193.5	13.00	180.5
Ragda	111.8	7.53	104.3
Surla	71.0	4.21	66.8

Siquerim	0.0	0	0.0
Main Mahadayi	234.6	52.0	182.6
Total MCM	809.0	89.8	719.2
TMC	28.6	3.2	25.4

318.

The witness was cross-examined by the learned

Counsel for the State of Karnataka and State of Maharashtra and certain questions were also put to the witness by the Tribunal. Therefore, the Tribunal proposes to refer to only those questions and answers which are found to be relevant by the Tribunal.

319.

A question was put to the witness to the effect that if

he was given a chance between providing water to human beings' and providing water to animals, how would he dete rmine his preference.

873

The answer given by the witness was that first priority would be for environment, and he would make his best attempt to look the interest of animals first, and then if water is available, he would make attempt to provide water for human beings. The witness further stated that if the environment is protected, then the same shall take care of human needs also. Another question put to the witness by the learned cross-examiner for the State of Karnataka was that when he had visited the drought prone Malaprabha area, had he noticed the conditions of people in the rural areas, who could not grow even a single rain fed crop due to the lack of water.

The answer given by the witness was this was mainly because of opting for water guzzling cash crop, like sugarcane.

320.

The attention of the witness was drawn to the Volume I of Master Plan prepared by the Panel of Expert, approved by the Government of Goa in the year 1999 (Volume 31 of III) which showed that Goa has planned utilization of 72.40 tmc for irrigation. Therefore, it was put to the witness that the

Government of Goa itself had ambitious plans for irrigation over the so-called requirement of water for environment and ecology.

874

After bringing the stated facts to the notice of the witness, his response was sought by the learned Cross-examiner.

The response was that whatever plans, Government of Goa has for requirement of water for various purposes, he would always make attempts to understand the needs of the hour, and if plans are against wildlife and ecology, he would oppose the same, as he has done so in past and shall continue to oppose the same in future also.

321.

Shri Mohan V. Katarki, learned Counsel for the State of Karnataka had thereafter stated that he had no further question to ask this witness in his cross-examination, and as such he closed his cross-examination.

322.

It was put to the witness by the learned Counsel for the State of Maharashtra that his claim that the diversion of 2.83 tmc by the State of Maharashtra, outside the Mahadayi basin, would result in irreversible damage to the environment, and would destroy the rich habitat and further disrupt its ecological

balance is incorrect and without any basis.

875

The suggestion put in question No.1 by the learned Counsel for the State of Maharashtra was denied by the witness.

323.

Thereafter, the Tribunal had posed certain questions to the witness to elicit more information on the subject.

324.

The attention of the witness was drawn to para 37 on page 37 of his Affidavit dated 11.11.2017 and, prima facie, the Tribunal was of the opinion that findings of the Research Report 107 are the basis for further recommendation Nos. 2, 3 and 5 made by the witness on pages 39 to 41 of his affidavit. Therefore, an information was sought from the witness as to whether the findings of the Research Report 107 of IWMI have been critically examined and accepted by the Ministry of Environment, Forests and Climate Change.

The answer of the witness was that as per his knowledge and information, the findings of the Research Report 107 of IWMI have not been examined and accepted by the Ministry of Environment, Forests and Climate Change. It was noticed by the

Tribunal that along with his Affidavit dated 11.11.2017, the witness has appended Annexure-IX, being an assessment of

environmental flow requirement of Indian River Basins (MARK-GOA/35) and attention of the witness was drawn to page 255 of his Affidavit dated 11.11.2017, wherein, it is stated that:

"The study has effectively not been supplied with observed flow data of reasonable amounts and quality. The date which have been acquired and used were primarily from publicity available sources (Internet) where data are outdated and no conclusion on the accuracy or even origin of the data could be made. If the situation with access to data in India is not changed, any further EFA will be largely speculative…."

325.

After the said exercise was over, the Tribunal wanted to know from the witness as to how the results of such study can be considered as reliable and recommended to be adopted for application. The answer given by the witness was that the result derived by using global flow data based and using e-flow calculator helps to get reliable data as per his knowledge.

326.

The witness was handed over relevant pages of a

document issued by the Ministry of Environment, Forests and

Climate Change, in April, 2015 titled as “STANDARD TERMS FOR

REFERENCE

(TOR)

FOR

EIA/EMP

REPORT

FOR

PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE

877

UNDER EIA NOTIFICATION, 2006" and the attention was drawn to page 48 of the said document wherein it is mentioned that environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year during the lean season and 30% of Monsoon flow during monsoon season and for remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge. Having so drawn the attention of the witness, a question was put to him as to why he had not considered the above guidelines. The response of the witness was that he was not aware about the guidelines mentioned in the document, MARK/37 and, therefore, he had no comments to offer.

This is the sum and substance of the evidence of Shri Rajendra P. Kerkar, AW-4.

Oral Evidence of AW-5 Shri S.T. Nadkarni for the State of Goa

327.

Now the Tribunal proposes to consider the evidence of Shri. Subrai T. Nadkarni, AW5, who has deposed on behalf of the State of Goa.

878

328.

Before taking up the discussion of the evidence tendered by Shri Nadkarni, it would be relevant to notice certain relevant facts.

329.

The Tribunal through an order dated 17.7.2015 had directed the party States to file Affidavit of Evidence of Witness/Witnesses dealing with Hydrology first, because there were serious disputes between the States regarding availability of water. By order dated 1.9.2016, it was clarified that on the next date of hearing the witness/witnesses who has/have filed additional affidavits, on the subject of Hydrology, on behalf of the State of Goa, would be cross examined by the learned Counsel for the State of Karnataka, as well as by the learned Counsel for the State of Maharashtra. It was further directed that after the cross examination of the witness/witnesses, who filed additional affidavits on the subject of Hydrology on behalf of the State of Goa, was over, by the learned Counsels for the States of Karnataka and Maharashtra, the witness/witnesses who have

filed affidavits on

questions on Hydrology, on behalf of the

State of Karnataka, would step into witness box to enable the

learned Counsel for the State of Goa and the learned Counsel for

879

the State of Maharashtra, to cross examine him/them, and thereafter the affidavits of other witnesses would be filed.

330.

However, while considering the testimony of Shri S.T. Nadkarni, witness on behalf of the State of Goa, the Tribunal vide order dated 23.11.2017 had noticed that his affidavit indicated that he was claiming to be a qualified Hydrologist, and his affidavit, as well as the study appended thereto, indicated that he has relied upon the data furnished in report by Shri Chetan Pandit, and thereafter, has undertaken an independent study regarding yield of sub-basins in the Mahadayi basin. Accordingly, the Tribunal had allowed the deposition of AW5, Shri S.T. Nadkarni, to be recorded and ordered that the affidavit dated 14.11.2017 filed by him, as Examination-in-Chief, shall be read into evidence, even as a Hydrologist.

331.

However, to be equitable and fair to the opposite side, the Tribunal had granted a liberty to the State of Karnataka, as well as to the State of Maharashtra, to examine any further

expert witness on Hydrology, if so desired, but this liberty granted was never availed of, either by the State of Karnataka or by the State of Maharashtra.

880

332.

In his Examination-in-Chief, the witness has stated that he has filed his Affidavit dated 14.11.2017 in evidence, as a witness appearing for the State of Goa, and that he has sworn the affidavit and has verified his signatures. The witness has further stated that along with the affidavit dated 14.11.2017, he has appended an Annexure-I, which is his CV, giving the details of his qualifications, experience and job profile, etc. The witness has further stated that he has also appended a document, Annexure-II, with his affidavit, which was his determination of Water Availability of sub-basins of Mahadayi basin and Water Demands for Mahadayi Basin and its Sub-Basins. He has also produced on record a report of the Western Ghats Ecology Expert Panel submitted to the Ministry of Environment and Forests, Government of India. He has further produced on record “A REPORT of the High Level Working Group on Western Ghats”, issued by the Ministry of Environment and Forests, Government of India, on April 15, 2013.

333.

In paragraph 2 and 3 of his affidavit dated 14.11.2017, (Volume 208), the witness has mentioned about his educational qualifications, experience, expertise and job profile. The witness

proceeds to state that the State of Goa is the smallest of all the States in the country, and yet it shows an astonishing diversity of endemic species, habitats and ecosystems. In paragraph 8 of his affidavit, the witness has classified the soil in the State of Goa as laterite, alluvial and sandy and that the major portion of the soil is of lateritic category. The witness has stated that lateritic soils are highly acidic in nature, sandy loam to silt in texture and well drained and are poor in lime, phosphorus and potash, but are fairly good in organic matter and nitrogen. According to the witness, alluvial soils are subject to inundation by saline water and are to be protected by bunds. The witness has mentioned that coastal land comprises a stretch of land which can be exploited for irrigation and multiple cropping and these soils are also acidic, sandy, loam and fairly rich in organic matter but deficient in phosphate and potash. The witness claims that there are three main types of paddy lands viz. Khajan, Kher land and Morod land and the local cultivators distinguish the different types of fields according to soil and rainfall condition and its nearness to the river side. The witness has also mentioned that

the State of Goa is an important producer of commercial crops such as cashew nuts, coconut, areca nut, pineapples, mangoes etc. The witness has further stated that fruits such as mango,

pineapple, banana, papaya, jackfruits etc. account for 27 per cent of the area including that under horticultural crops.

334.

According to the witness, Mahadayi which is also called as Mandovi, is the biggest river basin of Goa and the basin area of Mandovi in Goa is 1580 sq.km., which constitutes 42.70% of the area of the State itself. The witness has mentioned that with most of the rivers in the State being prone to tidal effects, almost 20-40 kilometers along its length, Mahadayi is the main river and practically a life line for the sustenance of the State of Goa and the agricultural needs of its people.

335.

In paragraph 14 of the affidavit, the witness has mentioned that the Mahadayi River rises in Jamboti Ghat, about 10 kilometers north-east of Sonasagar near Degaon Village in Khanapur Taluka, Belgaum district of Karnataka State, at an elevation of about 940 meters above the mean sea level. After mentioning the latitudes and longitudes, the witness has averred in his affidavit that, from its origin, for the first five kilometres,

the river flows in north-east direction and then flows approximately westwards till it enters the State of Goa near Villages Krishnapur and Codal on border of Karnataka and Goa

respectively.

The witness has informed that in Karnataka, Mahadayi river is joined by three important tributaries namely Bail Nadi, Kotni Nadi and Bhandura Nallah and flows through the Bhimgad Wild Life Sanctuary in Karnataka and Mahadayi Wild Life Sanctuary in Goa. The witness further proceeds to state in para 15 of his affidavit that river Mahadayi is joined by Surla river near Nanode about 7 km., downstream from the point where Mahadayi enters Goa.

According to the witness, the Kalasa Nallah originates near the Mauli Temple and flows in westerly direction for about 5 km., where it joins the Surla Nallah and then flows in a southerly direction as Surla or Nanode River. According to the witness the flow in the river Mahadayi and its tributaries reduces drastically in the non-monsoon and due to shortage of water in the rivers, the water has to be pumped from the mining pits into the river to provide water to Opa Water Treatment Plant and also Assnora Water Treatment Plant, for meeting drinking water needs of Bicholim, Bardez, Ponda, Tiswadi and other

Talukas, and therefore, as an inland waterways, is a way of life and life line of Goa. Diversion or abstraction by the State of Karnataka of any water will severely affect needs of water for Goa, including the navigational traffic. The witness has provided detailed breakup of the catchment areas of sub-basins of

Mahadayi River in paragraph 29 of his affidavit. The demands of various uses in the sub-basins of the inter State Mahadayi river vis-à-vis the requirements of water availability is as per Annexure-II, the synopsis of which is reproduced by the witness in para 30 of his Affidavit. After referring to the demands of various uses in the sub basins as reproduced in para 30 of his affidavit, the witness has expressed a view that Mahadayi Basin is a water deficit basin and when seen as a whole basin or as a sub-basin, one can clearly conclude that no waters can be diverted. The witness has mentioned that diversion if permitted, would change the Mahadayi river profile and will permanently and adversely affect the ecology of the estuarine region of the river, particularly the Khazan Lands. According to the witness, the State of Karnataka envisages to divert 20.13 tmc of water outside the basin to Malaprabha basin or Supa Reservoir citing shortages for drinking water and also fulfilling irrigation and hydropower needs, which is wholly inaccurate claim, because in fact, the State of Karnataka has sufficient water in the Malaprapha River. What is claimed in the affidavit is that in lieu of utilizing the waters in a

planned, organised, systematic and interacted manner of River Malaprapha, the Karnataka is planning to divert the Mahadayi waters to Malaprapha Reservoir. The witnesses has stated that

two Nallahs namely Joul and Bennihalla, whose basin area amounts to 5048 sq.km., which is almost more than double the area of Mahadayi basin and it is on record that 50% dependable yield and 75% dependable yield of those two rivers is to the tune of 16.39 tmc and 10.92 tmc, respectively, out of which only 1.50 tmc is being utilized. The witness has stated that Karnataka is planning to divert 7.56 tmc from Kalasa- Bhandura to Malaprapha for fulfilling the drinking water needs of twin city of Hubli - Dharwad and villages on the way, but the proposal is made without citing the existing present resources like Renukasagar Lake or provision of 0.216 tmc from Malaprabha Dam. After mentioning that the water supply demand itself is on a conservative scale, it works out to be about 2 tmc or so, and it is stated that major part of the need is already met from the existing sources and any additional requirement can be met by drawing water from nearby rivers in the State like Bedti and Kali. The witness has emphasised that the State of Karnataka has not properly conceived and planned its available water resources and massive industrialization in water scarce areas, allowing

huge growth of water guzzling crops like sugar cane in the Malapraha basin are some of the mis-managements, which have resulted in bloated figures of drinking water demands, only to

justify the diversions. The witness has asserted that the small provision of only 0.216 tmc needs for drinking purposes in Malaprabha project, itself shows poor planning and the mis-management of drinking water. According to the witness, water of an inter-State river does not alone belong to the State of Karnataka and the demands made by the State of Karnataka and State of Maharashtra, for trans-basin diversions, would result in irreversible destruction of not only the water bodies, but also ecology, bio diversity and environment at large. In paragraph 47(b) of the affidavit, the witness has stated that the projects planned by Karnataka and Maharashtra are in highly eco-sensitive zones
and
permission to the
Karnataka and
Maharashtra for diversion of water outside the basin would eventually lead to diversion of waters flowing through the six Wildlife Sanctuaries
and National Parks.

According to the

witness, the State of Goa objects to that abstractions or

diversions of water from the river basin by the States of

Karnataka and Maharashtra because the diversion would cause a

huge damage to the ecosystem.

336.

The water demand and availability for Mahadayi basin

and its sub-basins is mentioned by the witness in Annexure – II

appended to his affidavit. The witness has stated in para 4 of Annexure II that excluding the 509 sq.km. area from where water cannot be harnessed and utilized for various reasons, as described in the Amended Statement of Claims of the State of Goa, Volume 131 page 25, the remaining basin of Mahadayi river in Goa covers an area of 1071 sq.km. and extends over seven Talukas.

The witness maintains that Mahadayi basin in Goa encompasses 200 villages and also the cities of Panjim, Mapuca, Bicholim, Sanquelim, Valpoi and Ponda and 34.90% of the population is rural and 65.10% is urban. The witness has made a mention of the fact that there is a large floating population of tourists, as Goa is an international tourist destination. The witness has emphasised that the estimate, arrived by the Panel of Experts was a conservative estimate, without having the advantage of considering the important features which were responsible for bringing about a major change in the profile of the river. According to the witness, the said Panel of Experts had estimated the total water requirement of the State of Goa in the

Mahadayi Basin as 2674 Mcum (94.12 tmc) and that when the Panel of Experts was appointed by the State Government, the situation and circumstances, as existing in the State of Goa, were completely different and indeed certain events since 1998 have

completely changed and brought about a paradigm shift not only in the demographic estimates, but also in the consequential requirements of water, for the State of Goa, all of which were either not available to the Panel of Experts nor could they have been foreseen at that time. The witness proceeds to state that a large migrant population has settled in the State of Goa, dramatically changing the demographic features of the State. After referring to the reports pertaining to the study of hydrology of the Mahadayi basin submitted before the Tribunal, the witness has offered his comments of CWC study 2003, in paragraph 9 of his affidavit. The witness has offered his comments on the study prepared by Shri S.N. Huddar who is examined as an expert witness of the State of Maharashtra, in paragraph 10 of Annexure II, whereas comments offered on the study prepared by Prof. A.K. Gosain, who is examined by the State of Karnataka are to be found in Paragraph 11 of Annexure II.

The witness has

mentioned reasons for accepting Study prepared by Shri Chetan Pandit, an expert witness examined by the State of Goa, which

are in paragraph 12 of his Annexure II in page 39 of his affidavit. The witness has stated that Mahadayi river flows sustain forest and wild life in the Wild Life Sanctuaries and National Parks in the basin. According to the witness, in the State of Goa, Mahadayi

basin has Mahadayi Wild Life Sanctuary in Sattari, Bondla Wild Life Sanctuary in Ponda, Sattari and Dharbandora Talukas, Dr. Salim Ali Bird Sanctuary in Tiswadi and Bhagwan Mahavir Wild Life Sanctuary in Sanguem admeasuring about 448.50 sq.km. in the basin. The witness has further informed that the basin has also Bhimgad Wild Life Sanctuary in Karnataka admeasuring about 191 sq.km., which is contiguous with the Wild Life Sanctuary in Goa.

337.

In Table No. 9 the witness has brought out, information regarding the sub-basin wise cultivable area in Mahadayi basin in Goa State in hectare (Ha) which reads as under:

Sl. No.	Sub-basin	Cultivable area (in Ha)
1.	Ragada	5267.00
2.	Khandepar	18205.00
3.	Kotrachi	6308.00

4.	Kudne	4905.00
5.	Valvanti	3450.00

890

6.	Bicholim	2605.00
7.	Assnora	3450.00
8.	Surla	2960.00
9.	Siquerim	601.00
10.	Madei	43053.00
	Total	90804.00

338.

In Table No. 10, the witness has mentioned sub-basin wise requirement of drinking water per annum in Mahadayi basin in the State of Goa which reads as under:

“Sub -basin requirement of drinking water in Mahadayi basin in State of Goa:

Sl. No	Sub-basin	Population (2051 AD)	Rural Requirement in Mcum	Urban requirement In Mcum	Total in Mcum

1.	Ragada	11626	0.104	0.373	0.477
2.	Khandepar	96652	0.862	3.100	3.962
3.	Kotrachi	15035	0.134	0.482	0.616
4.	Kudne	48305	0.431	1.550	1.980
5.	Valvanti	22238	0.198	0.713	0.912
6.	Bicholim	34463	0.307	1.106	1.413

891

7.	Assnora	29563	0.264	0.948	1.212
8.	Surla	7918	0.071	0.254	0.325
9.	Siquerim	62294	0.555	1.998	2.554
10.	Madei	549349	4.899	17.622	22.521
	Total	877443	7.824	28.147	35.971

339.

In Table No.11 the witness has provided Sub-basin wise irrigation requirement in Mahadayi basin in Goa State which is as under:-

“Sub -basin wise irrigation requirement in Mahadayi basin in Goa State according to the witness, are as under:

Sl. No.	Sub-basin	Cultivable area (in Ha)	Water requirement (in Mcum)
1.	Ragada	5267.00	142.21

2.	Khandepar	18205.00	491.54
3.	Kotrachi	6308.00	170.32
4.	Kudne	4905.00	132.44
5.	Valvanti	3450.00	93.15
6.	Bicholim	2605.00	70.34

892

7.	Assnora	3450.00	93.15
8.	Surla	2960.00	79.92
9.	Siquerim	601.00	16.23
10.	Madei	43053.00	1162.43
	Total	90804	2451.73

340.

The Table No.12 prepared by the witness relates to

Sub-basin wise demand of various uses in Mahadayi basin in Goa

(in Mcum) which reads as under:

Sub-basin wise demand of various uses in Mahadayi basin in

Goa (in Mcum):

Basin	Dom-Estic	Live-Stock	Tour-ism	Indu-stries	Irriga-tion	Forest Mgmt	Environment	
							Recom-ended	Mi mu
Ragada	0.477	0.07			142.21		195.93	11

Khandepar	3.962	0.59			491.54		339.20	19
Kotrachi	0.616	0.09			170.32		102.25	58
Valvanti	0.912	0.14			93.15		89.08	50
Bicholim	1.413	0.21			70.34		87.10	49
Assnora	1.212	0.18			93.15		35.82	20
Surla	0.325	0.05			79.92		124.51	71
Siqueri	2.554	0.38			16.23		0.00	0.(
Kudnem	1.980	0.30			132.44		32.75	18

893

Madei stem	22.521	3.38			1162.43		411.20	234.6
			23.07	96.42		50.00		
Total	**35.97**	**5.39**	**23.07**	**96.42**	**2451.73**	**50.00**	**1417.84**	**808.9**

341.

The witness has further provided information relating to availability vis-à-vis demands, sub-basin wise (in Mcum) in Table 13 which reads as under:-

Table 13:

“Availability vis -à-vis demands sub-basin wise (in Mcum):

Sl. No.	Basin/Sub-Basin	75% dependable yield	Recommended demand	Minimum requisite demand
1.	Ragada	465.40	338.69	254.59
2.	Khandepar	803.10	835.29	689.59
3.	Kotrachi	219.30	273.28	229.38

4.	Valvanti	214.90	183.28	144.98
5.	Bicholim	210.20	159.06	121.66
6.	Assnora	81.70	130.36	114.96
7.	Surla	259.90	204.81	151.31
8.	Siquerim	--	19.16	19.16
9.	Kudnem	77.00	167.47	153.47
10.	Madei stem	951.80	1769.02	1592.42
	Total	**3283.30**	**4080.42**	**3471.52**

894

342.

The witness was cross examined by the learned Counsel for the States of Karnataka and Maharashtra. Certain questions were put to the witness by the Tribunal also. Having regard to the fact of the case, the Tribunal proposes to refer to the relevant questions and answers thereto.

343.

The attention of the witness was drawn by the Learned Counsel for the State of Karnataka to his affidavit dated 14.11.2017, and he was requested to turn to pages 61 and 62. It was pointed out to the witness that in Table 8, the water availability of Surla Sub-basin from 1964-2005 as given by the witness is 9.20 tmc at 75% dependable yield, whereas the water requirement of Goa in Surla sub-basin, as mentioned by the witness is 79.92 Mcum (2.82 tmc). The attention of the witness was also drawn to DPR of Kalasa diversion – 2010 (Vol. 19) wherein the diversion planned by Karnataka from Surla River (Kalasa Nallah) to Kalasa Dam and Malaprabha Dam is indicated to be 3 tmc and thus the total utilization planned by Karnataka

and Goa is 5.82 tmc and even after considering the calculation of Surla sub-basin made by the witness as 9.20 tmc and even after considering the utilisation of 5.82 tmc planned by both the

States, there would be, still a surplus of 3.38 tmc for meeting the needs of environment concerns, and therefore it was put to the witness that there would not be any damage or adverse effect on the ecology and environment in the Surla valley on account of diversion planned by the State of Karnataka.

The witness responded by stating that in para 15 of his Affidavit at page 9 he has illustrated the origin of Surla river till its confluence with River Mahadayi and what was being compared was only the irrigation requirement in Table 11 which is at page 64. While answering question No.3, the witness has reiterated that Surla River flows through the Mahadayi Wildlife Sanctuary and any diversion of water flowing into or outside is not permissible as per Section 29 of the Wild Life (Protection) Act 1972. The witness has further mentioned that from the analysis made, though some surplus water looks apparent, the whole Mahadayi system has to be looked into as a whole before deciding about any diversion. After referring to Table No. 13 of page 65 at Sl. No.10 the witness stated that it shows that the availability in the main Mahadayi stem is 951.80 Mcum and the

demand including the e-flows is 1769.02 Mcum. The witness has further asserted that the apparent surplus water, referred to in

question No.3 will have to make good the deficit in the main Mahadayi stem. The witness has reiterated that there would be definitely a huge damage to the environment and ecology, in case any water is diverted from Surla River or its tributaries.

344.

The witness was shown a map prepared by the State of Karnataka, super-imposing Mahadayi Wildlife Sanctuary and Bhimgarh Wildlife Sanctuary, and it was stated on behalf of the State of Karnataka that, it was clear that none of the project sites, of the projects planned by Karnataka fell within the contours of Bhimgarh Wildlife Sanctuary, whereas 8 projects named in the question, planned by the State of Goa, fell within the contours of Madei Wildlife Sanctuary. After bringing these facts to the notice of the witness his response was sought.

The witness in his reply has mentioned that on the map so marked, and handed over to him, the said projects have been marked to fall in Madei Wildlife Sanctuary but, even some diversion projects of Karnataka, as indicated in some documents, and the project reports submitted by the State of Karnataka,

before this Tribunal indicate that the projects of Karnataka do fall in the Bhimgad Wildlife Sanctuary or on the fringes of it.

897

345.

The witness was shown an extent of saline area in the State of Goa, as indicated in the National Wetland Atlas with regard to Goa, prepared by the Space Application Centre, Indian Space Research Organization, Ahmedabad. The table prepared by the Chief Engineer (ISW), WRDO, Bangalore, Karnataka indicating the saline area in the Mahadayi basin of the State of Goa was also shown to the witness. After showing the above mentioned documents, it was put to the witness that the wetland area in Goa is not more than 8486 hectares as compared to geographical area of 3,07,200 hectares which forms only 2.29 per cent and on this basis the wetland area in Mahadayi basin, which according to the State of Karnataka is the saline area , comes to only 36.18 sq.km. (3618 hectares). In view of these facts it was put to the witness that Goa was unjustified in claiming exclusion of 509 sq.km. (50,900 hectares) from the consideration in the estimation of the total yield of the Mahadayi basin, and the response of the witness was sought.

In reply, the witness has stated that the area of 509 sq.km.

is absolutely justified to be deducted from consideration in the estimation of the total yield of Mahadayi basin. The witness has

informed the Tribunal that he had moved throughout the basin, especially in the estuarine region and the area of 509 Sq.km. is the area which excludes the saline reaches of the Mahadayi River and its tributaries, and even small rivulets are falling, directly into the sea/saline reaches. The witness has further stated that the calculations in Table MARK-KA/22, are just pro rata calculations of the alleged coastal wetlands as calculated by the State of Karnataka, and do not in any way correspond, to the saline reaches to be excluded for the yield purpose.

346.

In question No.15, the witness was shown a statement prepared by the State of Karnataka based upon the Detailed Project Reports (DPRs) filed by the State of Goa before the Tribunal and he was requested to refer to Master Plan of Goa (Volume-31, Page 55 of Volume-1 – GOA). After showing the statement,

the witness was told

that the water utilization

planned by Goa in the Master Plan is 2050 Mcum (72.4 tmc) but

the DPRs filed by Goa are only in respect of 61 projects for utilization of 29.72 tmc as shown in MARK – KA/23 and thereafter it was put to the witness that by failing to file the DPRs in respect of 42.68 tmc (72.4-29.72 tmc), Goa has abandoned its claim to that extent and response of the witness was sought on the said

aspect. In answer, the witness has denied the suggestions made in the question. The witness has sought support to his claim from the statements made by the State of Goa, in the Amended Statement of Claims (Volume 131, page 15 para 18D(i)); wherein it is clearly mentioned that the demands of the State of Goa go well beyond the DPRs of 61 projects envisaged in the Master Plan. The witness has further mentioned that he has brought to the notice of the Tribunal his observations on the Master Plan prepared by Panel of Experts of Goa, which are to be found in paras 5 and 6, on page 29 of Annexure-II appended to his affidavit. The witness has asserted that the demands of the State of Goa have been worked out for each use and the same can be seen from Table 12, which is page 64. The witness was asked a question as to whether he can cite any inter-State or International River, where the natural flow is sought to be protected by the basin States, in the manner, as demanded by Goa in this case. The answer of the witness was he could not cite any such river either in India or any other country but maintained that National Water Policy, 2012 is very clear on the concept of

environmental flow as per Clause 1.3 (v) of the said policy.

347.

After the cross examination of the witness by Shri Mohan V Katarki, the learned Counsel for the State of Karnataka was over, the witness was cross examined by Shri D.M. Nargolkar, the learned Counsel for the State of Maharashtra.

348.

It was put to the witness that his claim about exclusion of area of 509 sq.km. from the total area of 2032 sq.km. in Mahadayi basin, on the ground that the said water could not be harnessed and utilized is incorrect and baseless and the response of the witness was sought.

In response the witness denied the suggestion. It was further put to the witness that the claim of the witness that diversion of 2.83 tmc by the State of Maharashtra outside the Mahadayi basin which is a relatively small fraction of the total yield of the basin, would face an imminent threat of choking and would disturb the ecology and would result in irreversible destruction of water bodies and bio-diversity and environment, is incorrect and without any basis.

In answer the witness denied the said suggestion.

901

349.

Thereafter, Shri D.M. Nargolkar, learned Counsel for the State of Maharashtra had made a statement that he has no further questions to ask to this witness and as such closed his cross examination.

350.

Shri Dattaprasad Lawande, the learned Advocate General for the State of Goa stated that no opportunity for any re-examination of the witness was required.

351.

Thereafter, certain questions were put to the witness by the Tribunal to elicit the best information regarding availability and demand of the water. The attention of witness was drawn to para 28 on page 13 of his affidavit dated 14.11.2017, and the witness was asked a question as to whether any scientific study has been undertaken and/or completed by the Government of Goa to examine the impact of diversion of water outside the basin and/or abstraction of water within the basin by co-basin States including the State of Goa, for meeting the demand of

water for various purposes such as drinking water, irrigation, power generation, industrial needs, navigation etc.

Another question which was put to the witness was that was there any study undertaken by the State of Goa indicating the impact of

902

diversion/abstraction of water for various purposes on navigation in quantitative terms.

352.

Before giving answers to the questions, the witness has stated that before submitting the Statement of Claims and the Amended Statements of Claims of State of Goa, he had read each sentence and all paragraphs of the said Statement of Claims and Amended Statements of Claims, respectively, and he reiterates and stands by each sentence and paragraph in the said Statements.

The witness has stated that the said Statements/Pleadings be considered as his evidence on oath.

353.

According to the witness, the State of Goa had made attempts to examine the impact of diversion/abstraction of water outside the basin by all the three States on navigation but due to absence of data on sedimentation, at Ganjim G & D, no inference could be drawn from the said exercise especially with regard to navigation. The witness has further stated that there would be definitely some effect, if water is diverted to outside the basin, as utilization in the basin itself will result in return of flows in the river.

It was pointed out to the witness that in the Table mentioned in para 30, on pages 14-15 and in the Table 13, on

903

page 65 of his affidavit dated 14.11.2017, (Volume 208), he has indicated the sub-basin wise availability of water in Mcum at 75% dependability in the second column, whereas in the third column, he has indicated the recommended demand and in the fourth column the minimum required demand of water is indicated.

354.

With reference to the above facts, the witness was asked as to what did he mean by the term “recommended”? and who had recommended these values. It was pointed out to the witness that he has indicated the availability of water in Sinquerim sub- basin as “ - ” and does it mean that the catchment area of Sinquerim sub-basin is outside the usable part of the Mahadayi basin as described by the witness in para 14 on page 40 of Volume 208.

The witness has answered that the term ‘recommended demand’ means the demand required for keeping the whole basin in the same state of environment and biodiversity. The witness has, further clarified that the whole Sinquerim sub-basin

is prone to saline effect and falls in the 509 sq.km. and therefore the availability of water is taken as nil.

904

355.

Attention of the witness was drawn to the Table to para 30, on pages 14 and 15 and Table 13 on page 65 of his affidavit dated 14.11.2017, (Volume 208), wherein the witness has indicated the sub-basin wise availability of water (in Mcum) at 75% dependability in the second column. It was noticed by the Tribunal that the total availability of water at 75% dependability has been shown as 3283.30 Mcum (115.9 tmc) and a question was asked as to why he has undertaken sub-basin wise assessment of water availability at 75% dependability and to sum up to arrive at a new yield figure for the Mahadayi basin.

The answer given by the witness was that he had carried out the arithmetic, by adding up the 75% dependable figure to find overall excess deficiency but he agrees, that for the whole basin, the overall of 75% dependability would be the effect of 13 Stations as evaluated by Shri Chetan Pandit, and that he stands by Shri Chetan Pandit's result of 113.5 tmc for the whole basin.

The witness has also stated that he had taken up sub-basins study, as he wanted to evaluate as to what would be the effect of

availability and demands in each sub basins.

905

356.

It was mentioned to the witness that in the Table mentioned in para 30 on pages 14 and 15, and in the Table 13 on page 65 of his affidavit dated 14.11.2017, the witness has indicated the sub-basin wise availability of water in (Mcum) at 75% dependability in the second column, whereas, in the third column he has indicated the recommended demand and in the fourth Column, the minimum required demand of water is indicated.

357.

On the basis of the information supplied by the witness, a question was put to him as to why he had not chosen to consider the total area of the sub-basin, falling in all the co-basin States, for assessment of water availability as well as demands of water for various purposes.

On consideration of the figures indicated in the Table on page 15 or in Table 13 on page 65 of his affidavit, it was found by the Tribunal that the overall demand for water is more than the availability of water, and obviously, all the

identified demands cannot be fully met either. Therefore, a question was put to the witness as to how did he plan to address such a situation, particularly with reference to prioritization of different projected demands, keeping in view the provisions of the National Water Policy 2012, and/or State Water Policies.

906

In answer, the witness has stated that his study is basically to study the demands of each sub-basin. He has claimed that in-basin demands of Karnataka are 1.857 tmc and that of Maharashtra are 3.53 tmc, as envisaged in their respective Statements of Claim and he has tried to find out sub-basin wise details, which he could not find in the documents and therefore, he had restricted the same, to the in-basin demands of the State of Goa itself. The witness has further added that the demands in Goa itself being more than 75% dependable flow in the river Mahadayi, confirms the fact that the basin is deficient. He has also stated that National Water Policy 2012, recommends sensitization of the demands within a basin, and it should be the need of the hour that the aforesaid National Policy is followed in letter and spirit and any water is not diverted outside the basin. The witness has stated that prioritization of meeting the demands, should be as per the National Water Policy 2012 and if demand is more than the available water, one may have to drop some of the Hydro-power schemes.

358.

It was brought to the notice of the witness that in his affidavit dated 14.11.2017, he has mentioned about adverse

impact of, diversion of water by the States of Karnataka and Maharashtra from Mahadayi basin on different aspects, such as, tourism, navigation, flora & fauna, waterfalls, environment, salinity etc. in the State of Goa, but it is not found by the Tribunal if there is any mention about the likely impact of such diversion on the flora & fauna, forest and wild life etc. in the Karnataka as well as Maharashtra territory of Mahadayi basin is made. Therefore, the witness was called upon to indicate whether these aspects were examined by him, and if so, what were his observations.

In reply, the witness has stated that, the adverse effect of diversion of water by Karnataka and Maharashtra in their respective territories would also be drastic. According to the witness Karnataka has proposed diversion in and around the Wildlife Sanctuaries, not only in Goa, but also in Karnataka and a lot of forest area will, not only be inundated, along with other areas, but the pumping from Kotni Dam of 7 tmc, with pumps of HP of more than 5000, will not only damage the whole environment but also change the climate in the region, as a huge

consumption of energy is envisaged in the area. The witness has further mentioned that in Maharashtra also, there would be

definitely an adverse effect on the environment and further in the case of Karnataka diversion, however, there would be a cascading damaging effect on the Wildlife Sanctuaries in Goa too as they are contiguous and environment does not follow the State boundaries.

359.

The witness was informed that it is noticed by the Tribunal that his Affidavit dated 14.11.2017 includes the demand for various sub-basins but the witness has not indicated the names of the identified projects/claims for meeting the identified demands as was done by the Panel of Experts, constituted by the State of Goa. It was further pointed out to the witness that the Tribunal was feeling that the identification of projects/schemes was necessary because, only then, it would be possible to assess the “utilizable water” out of the “available water”. The witness was cal led upon to inform especially about the names of the various projects/schemes identified by him and the quantum of utilizable water, through such projects/schemes.

The witness, in answer has stated that the State of Goa intends to meet the demands for major uses through the 61 projects identified by the Panel of Experts, however, in case of

some of the demands, it is not possible to prepare the DPRs, such as environment demands, tourism demands etc., but attempts are being made to identify more projects, especially like abandoned mining pits, construction of bandharas etc. for fulfilling the demands.

360.

The attention of the witness was drawn to what he has stated in para 23 on pages 43 and 44 of Annexure II of his affidavit dated 14.11.2017 and it was brought to his notice that although he has stated that the “evapo -transpiration will increase, and losses by direct evaporation from water bodies, reservoirs, canal surfaces and farms will also increase, he has chosen, not to account for such likely increases. Therefore, it was put to the witness that is it not a case of faulty planning and how Goa intends to meet the future challenges which have been duly flagged by him.

In answer, the witness has stated that it is a fact that global warming will result in increase in temperatures, which, in turn, will increase the evaporation losses and also the crop-water

requirements. The witness has mentioned that the issue was discussed at Government Department level and since water

saving measures would be implemented, the irrigation requirements are kept in line with the Master Plan prepared by Panel of Experts. The witness has further stated that this is not a case of faulty planning and that the State plans to provide for micro-irrigation and water saving techniques to counter for the global warming. The witness has also stated that crop-water requirement will definitely increase due to global warming, however, because of the above measures envisaged, the irrigation demands would be met.

361.

The attention of the witness was drawn to what he has stated in para 23 on pages 43 and 44 of Annexure II of his affidavit dated 14.11.2017, and with regard to the facts mentioned in the said para a question was put as to what are the likely impacts of global warming and climate change on water availability of Mahadayi basin and the quantity of likely increase or decrease in the waters of Mahadayi basin, say by 2050 AD. A question was further put to the witness as to what is the estimated quantity of losses due to increase in evapo-

transportation, direct evaporation from water bodies, reservoirs, canal surfaces and farms, etc.

911

The witness, in answer has mentioned that though there would be impact of global warming on the water availability in the Mahadyi basin, the State of Goa has not estimated the same. The witness has further stated that the estimated quantity of losses in each project, due to increase in evapo-transpiration, direct evaporation from water bodies, reservoirs, canal surfaces and farms etc. has also not been estimated.

362.

The attention of the witness was drawn to what is stated by him in para 6 on pages 29 and 30 of Annexure II of his affidavit dated 14.11.2017 and a question was put as to why assessment of sub-basin wise water availability and water demands, instead of assessment of project wise water availability and water demand, are considered necessary. Another question which was put to the witness was as to would such approach to the basin planning viz., restricting the planning of sub-basin, not put severe restrictions in planning for optimal utilization of water resources of Mahadayi basin.

The response of the witness was that the aim of his study

was to find out the water demands in each sub basins vis-à-vis, the availability of water and to ascertain whether any water was

surplus/deficient sub-basin wise, as well as for the whole basin. It was mentioned by the witness that projects are planned as per the availability of water. The witness has further stated that restricting the planning to sub basin, in his opinion, shall not put severe restrictions in planning for optimal utilization of water resources in Mahadayi basin.

363.

The witness was requested to refer to table 12 on page 64 of Annexure II of his affidavit dated 14.11.2017, and it was pointed out that the Tribunal did not find any mention about the water needs for Hydro-power development in the State of Goa. Therefore, the witness was called upon to indicate the details of water requirement of Goa for Hydro-power development, if any, in this regard.

In answer, the witness has stated that he has not mentioned the water requirements of Goa for Hydro-power development in his study, but he wishes to rely upon para 18D (i) of the Amended Statement of Claim of the State of Goa (Volume-131), and also the Master Plan prepared by the Panel of Experts

of the State and he has mentioned that he reiterated the same.

913

According to the witness the requirement for Hydro-power is 28.137 tmc.

364.

The witness was asked a question as to whether he had undertaken any in-depth scientific evaluation of the issue of prioritization of various uses of water with due consideration of social, economic and environmental aspects and particularly in the context of prioritization among in-basin uses and utilization through extra basin diversion and if such in-depth scientific evaluation has been undertaken, what are the findings thereof. The witness has mentioned in the answer that the in-depth scientific evaluation of prioritization has not been undertaken by him but the prioritization would be followed as per the National Water Policy 2012, or any other policy in force at the relevant time.

This is the sum and substance of the evidence of Shri Subrai T. Nadkarni, AW5.

914

Oral Evidence of RW-3

Karnataka

365.

Shri S.M. Jamdar for the State of

The Tribunal has already discussed the evidence of witnesses, produced by the State of Goa, and now it proposes to discuss the evidence led by Shri S.M. Jamdar, RW-3, examined on behalf of the State of Karnataka, who has deposed on three questions, namely:-

i)

Whether the Taluks of Bailahongal, Ramdurg and Saundatti of Belagavoi district, Badami Taluk of Bagalkot district and Ron taluk of Gadag district, are drought prone areas?

ii)

Whether by transfer of 5.527 tmc of Mahadayi water to Kali Hydro Electric Project, more power can be generated on the existing infrastructure?

iii)

Whether the Mahadayi Hydro-power Project (Kotni HEP), which is non-consumptive, is feasible for augmenting the power to meet the peak demand in Karnataka?

915

366.

His Examination-in-Chief was recorded

by the

Tribunal on 29.11.2017 and he has stated that he had sworn his affidavit on 0.11.2017 and filed the same before the Tribunal on 14.11.2017 as evidence, which be treated as his Examination-in-Chief. He had identified his signatures on the aforesaid affidavit. Along with the affidavit, the witness had appended three documents which were taken on record and marked as MARK-KA/29, MARK-KA/30 and MARK-KA/31(Colly.).

367.

In para 1 and 2 of his affidavit, the witness has

mentioned about his educational qualifications, expertise, experience and job profile. The witness has stated that the Govt. of Karnataka had requested him to depose before the Tribunal and that he had accepted the said request after going through the pleadings and materials on record. In para 5 of his affidavit, the witness has stated that three Taluks of Belagavi district viz. Saundatti, Bailahongal and Ramdurg and one Taluk, namely

Badami of Bagalkot District and one Taluk i.e. Ron of Gadag District in Malprabha command area, are drought prone, posing serious challenge for meeting agriculture and drinking water needs. The witness has stated that the Govt. of India, based on the report of Prof. Hanumantha Rao Committee has identified

916

Taluks in Desert Development Programme (DDP) and Drought Prone Area Programme (DPAP) and one Taluk namely Badami is covered under DDP, whereas the three Taluks of Belagavi District, namely Bailahongal, Ramdurg and Saundatti and Ron Taluk of Gadag District, are classified as DPAP. In para 6 of his affidavit, the witness has reproduced Table, which demonstrates the DPAP/DDP area and the area coming under irrigation by surface water. The said Table reads as under:-

Area in Hectares

Sl. No.	Taluk	Culturable area and Geographical area for the year 2012-13	Area under DPAP	Area under DDP	Area under Mala-prabha comm-and	Area under other major and medium projects	Ar ur M Ta
1	2	3	4	5	6	7	8
1	Bailhongal	89615 112233	112200	Nil	7667	-	45
2	Saundatti	123811 158146	158000	Nil	36083	-	-

3	Ramdurg	96101 121542	114000	Nil	18164	-	14
4	Badami	93940 139420	Nil	Whole Taluk	28565	-	-
5	Ron	120941 129091	128600	Nil	34268	-	-

368.

In para 7 the witness has referred to the chart of rainfall data of Malaprabha basin for 47 years, as prepared by the Karnataka State Natural Disaster Management Centre and has annexed the same, to his affidavit, as Annexure-1. According to

the witness, the chart shows that almost two, in every four years, witnesses failure of or inadequate Southwest Monsoon rains, which leads to drought. The witness has further stated that sometimes, drought continues for consecutive two to three years, which creates worst situation for any Government to handle. The chart of various Taluks declared as drought affected by the Govt. of Karnataka at Malaprabha Basin from 2001 to 2016, is annexed by the witness as Annexure-2 to his affidavit. According to the witness Malaprabha is designed to provide irrigation, largely to the drought prone areas, but the actual yield of water into the Malaprabha reservoir has been deficit by 17 tmc and as against designed intake of 44 tmc, on an average, about 27 tmc of water, is actually reaching the reservoir. What is claimed by the witness is that, it is necessary to augment the water availability by diverting Mahadayi water to Malaprabha Project and the witness has reproduced a Table which provides the details of the irrigation command of Malaprabha Project in DPAP and DDP Taluks, which reads as under:

918

“ Sl.

No.

I

District and Taluks

Ultimate Irrigation

Potential (in Hect.)

Belagavi District Taluks

1) Bailhongal

2) Ramdurg

3) Saundatti

Total of Belagavi District

7667

18164

36083

61914

II

Bagalkot District

1) Badami

28565

III

Dharwad District

1) Navalgund (Non-DPAP)

2) Hubli

Total of Dharwad District

38552

4382

42934

IV

Gadag District

1) Nargund (Non-DPAP)

2) Ron

3) Gadag

Total of Gadag District

Grand Total

27761

34268

690

62719

196132”

369.

The witness has further stated that, the existing ten Lift Irrigation Schemes in the foreshore areas of the reservoir, cater

to irrigate some of the DPAP areas in Bailhongal and Saundatti Taluks which were also the areas where project displaced families have been relocated. The witness mentions that the total area irrigated by these ten Lifts Irrigation Projects is 26,971 Hectares as per the Modified Detailed Project Report of the Malaprabha Project.

370.

In para 10 of his affidavit, the witness has again drawn a Table, which according to him indicates the meager rainfall and had negative deviation. The Table reads as under:-

Sl No	Taluk	2003		2004	
		R.F. (mm)	% deviation	R.F. (mm)	% deviation
1.	Bailhongal	375.6	(-)61	565.6	(-)41
2.	Ramdurg	316.1	(-)44	651.8	(+)16
3.	Saundatti	325.0	(-)48	487.7	(-)22
4.	Ron	401.3	(-)40	690.5	(+)4

5.	Badami	315.3	(-)49	724.1	(+)17

371.

The witness has further proceeded to state that, the inflow into Malaprabha reservoir in 2003-04 and 2004-05 was 16.25 tmc and 24.25 tmc respectively as against the average inflow of 36 tmc. The witness has stated that the successive years of drought had resulted in unrest among the farmers and people

of these Taluks were on the verge of creating law and order problems. According to the witness, the rainfall deficiency gave rise to critical drinking water crises and the Government issued necessary orders for remission of payment of revenues by the farmers and the loans payable by the farmer were re-scheduled by the Banks on the intervention of the Government.

The

witness has mentioned that the Central Assistance to the extent of Rs.1148 crores was also sought for drought relief measures in the Karnataka State, out of which only Rs.84 crores were sanctioned by the Central Government. According to the witness, the plea of the State of Karnataka for transfer of 7 tmc of water to Malaprabha reservoir from surplus water at Kotni Dam for providing protective irrigation, drinking water needs, etc. will go a long way in mitigating hardship caused to the inhabitants in drought prone areas in Malaprabha basin. The witness has proceeded to state that Hydropower is renewable, non-polluting and environmental friendly source of energy. The witness has referred to the National Electricity Policy announced by the

Government in February, 2005 and has stated that the said policy has identified the hydro generation as a thrust area for development and the preferred source of power, particularly in the context of rising fuel cost. The witness has mentioned that

921

the hydro power generation is the highly capital intensive, but being a renewable source of energy with no involved consumables, there is very little recurring cost and hence no long term expenditure.

372.

In para 16 of his affidavit, the witness has mentioned that generation of power in the State is not matching with the accelerated demand for power from industrial sector and has pointed out that the annual peak demand in the year 2011-12 was 12176 MW, whereas the supply was only 8401 MW. The witness has stated that the unrestricted demand for energy in the State in the year 2012-13, up to December 2012 was 4839 Mu; whereas the actual supply was 41958 Mu, leaving a deficit of 6391 Mu.

The witness has mentioned in his affidavit that Karnataka State, at present, has an installed capacity of 9912 MW and at present there is severe shortage of power, which has necessitated power cuts to the order of 50% on H.T. consumers and even L.T. consumers are not spared from the scheduled and

unscheduled power cuts. After referring to the location of Mahadayi and Kali basins in Western Ghats, it is emphasized that the diversion of water from these projects to the existing Supa reservoir will augment the storage of water in Kali basin, which

will help increased generation and also for generation during peak hours by utilizing the high installed capacities in the basin.

373.

The witness has mentioned that the State of Karnataka has proposed diversion of 5.527 tmc of water from Mahadayi water to Kali reservoir basin for augmenting the power generation at Kali Hydro Electric Project and among the southern States, the power project in Karnataka has been in shortage. The witness has informed the Tribunal in his affidavit that the shortage is being made up, annually, by drawing power from the Grid and purchases from the neighboring States, including the State of Maharashtra.

374.

The witness has stated that under KHEP, a huge dam known as Supa Dam across the river Kali was constructed with a capacity of 147.54 tmc and live capacity of 132.71 tmc, but the yield release is 94.74 tmc and in 28 years, the Kali dam filled up only twice, as a result of shortage in inflows. According to the witness, the State has not been able to operate and generate the

full installed capacity of power in Kali project. The witness has maintained that the State of Karnataka, has therefore, proposed a diversion of 5.527 tmc of Mahadayi water to Kali and if this

water is diverted, it will generate about 182 Mu power from the existing infrastructure at KHEP.

375.

The witness has mentioned that State of Karnataka has proposed Mahadayi Hydro-power Project at Kotni, across Mahadayi river which is non-consumptive in character with installed capacity of 200 MW and to generate 337.73 MU of energy. The witness mentions that the energy generated would contribute to meet the much needed peak demand, and since this Project, does not consume any water, except for evaporation losses of about 0.40 tmc, it would not adversely affect the downstream interests.

376.

This witness was Cross-examined by the learned Counsel for the State of Goa and certain questions were also put to the witness by the Tribunal. Having regard to the facts of the case, the Tribunal proposes to discuss only those questions and answers, which are found to be relevant. The attention of the witness was drawn to para 12 at page 12 and para 13 of his

affidavit dated 9.11.2017 by the learned Cross-examiner, on behalf of the State of Goa. It was noticed by the learned Cross-examiner, for the State of Goa, that while making a statement

in the above mentioned paras, the witness had not taken into consideration the environmental impacts of stoppage of water, diversion, the construction works including the river diversion works, etc., and therefore, it was put to the witness that the statement made by him in paras 12 and 13, which were quoted in question No.7 are without any basis whatsoever and without conducting any study to that effect.

The response of the witness was that he was not an expert in hydrology and power engineering, by way of having any professional degree or education and training, but he had worked as a Managing Director of Karnataka Power Corporation Ltd., for about three years, which constructed, and today owns and operates nearly 40000 MW of hydel power, in environmentally most difficult area and that the State of Karnataka is aware of the environmental issues and had considered them. The witness further stated that the State of Karnataka will be able to take care of those issues, as and when situation arises, with the relevant authorities in the Government.

377.

After the cross-examination by Shri Dattaprasad

Lawande, the learned Advocate General for the State of Goa was

over, Shri Lawande had stated that he had no further questions to ask this witness in his cross-examination and as such he had closed his cross-examination, and therefore, Shri D.M. Nargolkar, the learned Counsel for the State of Maharashtra was requested to cross-examine the witness, but Shri Nargolkar had stated that he did not want to cross-examine this witness. Therefore, certain questions were put to the witness by the Tribunal.

378.

The attention of the witness was drawn to what he had stated in para 8 at page 8 of his affidavit and a question was put as to how he had arrived at the conclusion that “it is necessary to augment the water availability by diverting Mahadayi water to Malaprabha Project” before examining all issues, particularly reliability of the assessment of water availability of river Mahadayi at different locations and its tributaries vis-à-vis water requirements for various purposes in Mahadayi basin. The Tribunal had further noticed that it was apparent from the statement made by the witness that Malaprabha Project is designed to provide irrigation to the

drought prone areas and the suggestion of the witness for augmenting the water availability by diverting Mahadayi water is aimed to overcome the shortfall in irrigation to drought prone

area. Therefore, a question was put to the witness as to whether he had examined all other possible alternatives for overcoming the shortfall in irrigation water needs in drought prone areas, viz. the possibility of demand side management, such as, use of micro-irrigation, appropriate choice of cropping pattern, etc.

In answer, the witness stated that he was not in a position to comment on the reliability of assessment of water availability in the river Mahadayi at different locations and its tributaries, vis-à-vis water requirement for various purposes, since he was not technically competent to do so. The witness further stated that he presumed that the technical experts must have done the assessment using their due diligence, basing their conclusions, on the relevant technical parameters, and hence he believed that the aforesaid assessment was correct.

379.

The witness further stated that the State of Karnataka has made the huge investments in the development of irrigation command such as canals, distributaries, FIC, land levelling, etc., which is going waste in view of the deficiency observed in later

years and this factor was also taken into account. The witness has further stated that the M&G CADA did make efforts to salvage

the situation by way of resorting to water saving measures such as drip irrigation, sprinkler irrigation, re-cycling of the drainage water and the like and yet the deficient situation does continue to a considerable extent. The witness stated that other than diverting water from the upper basin like Mahadayi, there does not seem to be any more viable way of augmenting the water. The witness added that Mahadayi basin water to the extent of the quantity of water that is generated within the boundary of Karanataka, not only is flowing into the State of Goa, but also is not being at the present harnessed by the basin States, and therefore, he felt that it is necessary to augment the deficiency found in the Malaprabha basin by way of diverting some quantity of water that would be available from Mahadayi basin to salvage the situation as much as possible.

380.

The pointed attention of the witness was drawn to paras 11 and 12 of his affidavit and the statements made by the witness therein were brought to his notice. The Tribunal was of the view that the drinking water supply must be planned from

highly reliable sources, which have availability of water at 100% dependability. Therefore, a question was put as to how can the 100% dependability be ensured through the surplus water at

Kotni dam, which would generally be available only in those years when actual rainfall is more than the average rainfall.

381.

The Tribunal had further noticed that the surplus water cannot be considered to be available in each year and particularly during the drought years when there would be no surplus at all, and therefore, it may not be appropriate to assume that the plan to transfer such surplus water will help in mitigating the hardship to the inhabitants during drought periods. Therefore, a question was put to the witness, as to whether he had examined all these aspects, and how such measures would help providing protection to irrigation and mitigating the hardship of the inhabitants of drought prone areas during the drought period.

In response, the witness stated that the diversion of Kotni Dam water was not intended for drinking water supply and it was basically for power generation and protective irrigation in the drought prone areas. According to the witness the word appearing in his affidavit drinking water was a mistake and he

apologized for the same. The witness further stated that during the drought years, definitely there may be deficiency in flow at

929

Kotni Dam and consequently, deficiency in the quantity of water to be diverted for protective irrigation in the Malaprabha Project, but that kind of risk has to be taken and at least in the years whatever quantity of water is available, that will be useful.

This is sum and substance of the evidence of Shri S.M. Jamdar (RW-3).

Oral Evidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

382.

Having discussed the testimony of Shri S.M. Jamdar, RW3 examined by the State of Karnataka, the Tribunal now proposes to discuss the evidence of RW4 Shri G.M. Madegowda an expert witness examined on behalf of the State of Karnataka on the drinking water demand of Hubli-Dharwad en-route villages, etc., from Malaprabha reservoir.

The witness has tendered his affidavit dated 9.11.2017 on 14.11.2017 (Volume 207). The Examination-in-Chief of the witness was recorded on 29.11.2017. After tendering his affidavit dated 9.11.2017 before the Tribunal, the witness has verified his

signatures on the affidavit and has reiterated the contents of his

affidavit. Along with his affidavit, he has filed Annexures 1 to 6 which were taken on record, by the Tribunal.

383.

In paragraph 2 of his affidavit dated 9.11.2017, the witness has given details about his educational qualifications, expertise, experience and job profile. The witness has mentioned that “Report on the Drinking Water Demand of Hubli -Dharwad en route villages, etc., from Malaprabha reservoir was prepared under his authority as the Chief Engineer, North Zone Dharwad. The witness has stated that in November 2012, the said report was submitted to the Chief Engineer, WRDO, Bangalore and subsequently the report was filed before the Tribunal on 2.1.2013 which is exhibited as Exhibit No. KAR-67 (Volume 16). According to the witness, the old sources of water supply to Hubli-Dharwad were, Unkal and Kelageri tanks of the storage capacity of 2.27 Mcum (0.08 tmc) and 1.70 Mcum (0.06 tmc) respectively. The witness has stated that Kelageri was abandoned long ago whereas Unkal was abandoned in 1996. According to the witness the first stage water supply system from Neerasagar

reservoir, was commissioned in 1955 and had a capacity of 6.50 Mcum/year (0.229 tmc/year) and later in the second-stage, it was augmented to 14.47 Mcum/year (0.51 tmc/year) in the year

1969, but the Neerasagar reservoir of the storage capacity of 1.02 tmc is not reliable source as it rarely fills up as is evident from the extracts of the log books. The witness has mentioned that the Government of Karnataka, in an effort to find a dependable source for providing emergent relief to the inhabitants of Hubli-Dharwad, identified the readily available Malaprabha storage in 1981.

The witness has informed that

Malaprabha source was developed in two stages and in the first stage namely “Malaprabha Water Supply Scheme to Hubli - Dharwad Municipal Corporation”, 34 MLD was planned in 1983 and in the second stage namely “Malaprabha Water Supply Scheme to Hubli- Dharwad” the drawl from the Malaprabha was increased to 68 MLD in 1983 but subsequently due to aging and maintenance problems and also to improve the energy efficiency, these two schemes were stopped and a new bulk water supply system head-works to Water Treatment Plant of the capacity of 73.80 MLD was planned under the scheme “Emergency Improvement to Water Supply System to Hubli-Dharw ad city”

which was commissioned during 2004.

The witness has

mentioned that due to the increase in population and also due to uncertainty of filling up of Neerasagar reservoir, bulk water supply improvements, were taken up from Malaprabha reservoir

during 2011 under the scheme namely “Bulk Water Supply Improvement to Hubli-Dharwad Twin City with Malaprabha reservoir as source” and in this scheme drawl of another 80 MLD water was planned and implemented and thus the total water drawls from Malaprabha Dam as in 2011 was 153.80 MLD (1.98 tmc), for meeting the drinking water requirements of Hubli-Dharwad en route villages and Kundagol Town. In paragraph 7 of his testimony the witness has stated that the total projected demand, from the Malaprabha Dam for these areas i.e. Hubli-Dharwad en route villages and Kundagol Town, has been estimated as 7.65 tmc by 2044. In paragraph 8 of his affidavit the witness has mentioned about a detailed energy audit, reported by Tata Energy Research Institute during 2002 and detailed energy audit, conducted and reported by Tata Energy Research Institute, has been annexed as Annexure-I with his affidavit. In paragraph 9 of his affidavit, the witness has referred to report submitted by “Bristol Water Services Austria GmbH as Annex ure-2 to his affidavit and has proceeded to state that based on the above study, improvement to bulk water supply and distribution

system are progressively taken up. The list of various measures, undertaken by the government agencies for improvement of bulk water supply and distribution system of Hubli-Dharwad, is

produced by the witness as Annexure-3 with his affidavit. The witness maintains that due to the above projects, about 1/3 population of Hubli-Dharwad city of 3,21,000 is now supplied water with continuous pressurized water supply system and in order to extend continuous pressurized water supply system, to the entire city and to improve bulk water supply system, a detailed project report has been prepared by Tata Consulting Engineers and the recommendations made by Tata Consulting Engineers, are reproduced by the witness on page 9 of his affidavit.

According to the witness, the Government has approved “Karnataka Urban Water Sector Improvement Project Upscaling 24x7 continuous Water Supply to cover entire corporation of Hubli- Dharwad” at an estimated cost of Rs.1,14,600 lakhs and the work under the project is in progress through Karnataka Urban Infrastructure Development and Financial Corporation, which on completion, would provide infrastructure for 24x7 continuous water supply of 5.20 tmc drawn from Malaprabha Dam.

384.

In Paragraph 13 of his affidavit the witness has dealt with alternative sources for Hubli-Dharwad en route villages, etc., and has stated that Malaprabha source, was identified, because

of its proximity to Hubli-Dharwad and also because of availability of source storage and also as per the instructions of the Government. What is mentioned by the witness is that water supply from Almatti Dam, Supa Dam, Tungbhadra Dam and Bedti River were techno economically not feasible as revealed in the "Report on Drinking water demand of Hubli -Dharwad en route villages etc. from Malaprabha reservoir" filed 02.01.2013 (page 23, Volume 15). According to the witness ever since the project for drawl of water from Malaprabha dam was commenced, there have been conflicts between irrigation demand and drinking water supply, more particularly during summer months, as water level in the dam would fall so low, from February to June, that drawl of water for drinking water supply would become contentious between City Corporation and the farmers.

The witness informs the Tribunal that the farmers of Malaprabha command, farmer organization

and

Kannada

Cultural

Organizations would resort to protest whereas the general public of the city, have resorted to dharnas, bandhs, strikes, disrupting the public transport system, etc. which has resulted in drinking water supply getting disrupted. According to witness, the newspaper clippings reveal that demonstrations, dharnas, hunger strike, sit-ins, and city bandhs, occasionally even leading to the

stoppage of pumping system and water treatment plants, have been resorted to by the farmers against the drawl of water from the dam. The witness proceeds to state that this is the situation in regard to the existing drawl of about 1.98 tmc and therefore, it is imperative to augment the Malaprabha dam by diversion of Mahadayi waters to the extent of 7.56 tmc, to provide sustainable drinking water supply to Hubli-Dharwad en route villages, etc., and once the Mahadayi diversion takes place, the Malaprabha water drawn from the Malaprabha dam can be restored for utilization by farmers etc. in Malaprabha command area.

385.

According to the witness, the population of Hubli-Dharwad twin city as on 1901 was 81,143 and as on 2011, it was 9,43,857 whereas the population of Kundgol town and en route villages as on 2011, is 18,719 and 1,01,838 respectively, and the projected population of Hubli-Dharwad twin cities en route villages and Kundgol town are worked out, based on the Central Public Health & Environmental Engineering Organisation manual

of the Ministry of Urban Development, Government of India on water supply and treatment in the year 1999. The witness has produced the said manual as Annexure-6 with his affidavit.

As

936

per Annexure-6 the population figures indicated from 1981 up to 2051 is as under: MARK-KA/36 which is to be found on page 264 and 265. The witness further states that the State Government has improved the water supply infrastructure and at present the works undertaken would ensure supply of 5.20 tmc ft of water on 24x7 basis if Malaprabha dam is augmented by Mahadayi waters, to the extent of 7.56 tmc.

386.

The witness was cross examined by the learned Counsel Shri Duttaprasad Lawande, learned Advocate General for the State of Goa and several questions were put to the witness. The Tribunal had also put certain questions to the witness, to elicit better information regarding the drinking problem existing in Hubli-Dharwad twin cities. In question No.1, the attention of the witness was drawn to para 4 on page 3 of his affidavit dated 9.11.2017 and a question was put to the witness that the documents mentioned in the question did not form part of the report at Volume No.16 whereas those documents were prepared subsequently, tailor-made to suit the report and

inserted in the report, before it was submitted to the Tribunal, and the response of the witness was therefore, sought on the point that the report titled as “Report o n Drinking Water Demand

of Hubli-Dharwad, En-route villages, etc. from Malaprabha reservoir" at Volume 16, was only unreliable and untrustworthy and could not be relied upon. In answer, the witness admitted that there as an apparent mistake in para 5 at page 3 of his affidavit and in fact the correct month in which his report was submitted to the Chief Engineer WRDO Bangalore was December 2012. Having offered the above stated explanation the witness expressed his apologies for the mistake and stated that suggestion given in the question did not subsist in view of his explanation.

387.

Again in question No.2, a suggestion was put to the witness that it was apparent from the cover page of the said report at Volume No. 16 that the report was prepared in November, 2012 itself and therefore the said report was wholly unreliable and untrustworthy.

In answer to the said suggestion the witness stated that the report was prepared by his subordinate Executive Engineer in November 2012 and he had verified the same during the month

of December 2012. According to the witness he had a discussion with his subordinate Engineer and a number of corrections were

made in the office of the Chief Engineer and finally it was submitted to the Chief Engineer, WRDO Bangalore in the month of December 2012. The witness added that at the time of finalization of the report, in the office of the Chief Engineer, certain documents were appended to the Report, which were dated later than the preparation of the report by the Executive Engineers. The witness further stated as under:

"… I t appears that the Report which was finalized in the month of December, 2012, and was so submitted to the Chief Engineer, WRDO, Bangalore in December, 2012, was through an inadvertence, still titled as that of November, 2012. The aforesaid Report was, finally, submitted by the State of Karnataka before this Hon'ble Tribunal on 02.0 1.2013".

388.

In question No. 5, it was mentioned to the witness that water required for population of twin cities of Hubli and Dharwad, as per census of 2011 as provided by the witness in Annexure-6, would work out to 1.64 TMC only, considering that

the total population as on 2011 is 9,43,857 and recommended maximum per capita supply is 135 litres per day. Having so mentioned, the response of the witness was sought by the learned Cross Examiner on behalf of the State of Goa.

939

The witness responded by stating that the domestic requirements of Hubli-Dharwad will be 135 LPCD i.e. litres per capita +15% for Unaccounted for Water as per note (ii) of Table 2.1, and further the institutional needs of the water shall also have to be taken into consideration. question No.7 put to the witness indicates that based on the information available from data at MARK-GOA/38, the State of Goa had prepared a chart titled “Calculation of Yield at Neerasagar reservoir” copy of which was handed over to the witness and it was pointed out to him that there should be no difficulty, in regular filling of Neerasagar reservoir of Bedti river which is a west flowing river and therefore the statement made by the witness that reservoir fills rarely which allegedly is based on extracts from log books was incorrect and that not only the reservoir should fill up regularly but there would be surplus water available in Neerasagar reservoir catchment, than the capacity of the reservoir. Having drawn the attention of the witness, as mentioned above, the response of the witness was sought. The witness stated that he had made the statement in the affidavit on the basis of log books recordings,

maintained by the Karnataka Urban Water Supply and Drainage Board, however, the said log books are not available with him

940

and that since the Neerasagar reservoir does not regularly till up to its capacity, the question of any surplus water does not arise.

389.

After the cross examination of the witness by the learned Counsel for the State of Goa was over, a statement was made by Shri Dattaparasad Lawande, the learned Advocate General of Goa that he has no further question to ask the witness in his cross examination and as such he has closed his cross examination.

Thereafter Shri D.M. Nargolakar, the learned Counsel for the State of Maharashtra was requested to cross-examine the witness but Shri Nargolkar has stated that cross examination of this witness by him was not necessary. Therefore, the Tribunal has put certain questions to the witness.

390.

In question No. 3, the attention of the witness was drawn to para 11 on page 9-10 of his affidavit dated 9.11.2017 and the witness was called upon to state as to why “Karnataka Urban Water Sector Improvement Project Upscaling 24x7

continuous water supply to cover the entire corporation of Hubli-Dharwad” has been planned for 5.2 tmc and how a project can be approved and work on the same started by the State Government with a river subject to allocation by this Hon’ble

941

Tribunal and why the scheme has been prepared and approved without identifying reliable and confirmed sources of water. The response of the witness was that it is planned to provide an assured and pressurized continuous water supply to Hubli-Dharwad Corporation area to a projected population of the year 2041 and the 5.2 tmc of water required for that purpose has been planned by the Consultants of Karnataka Urban Infrastructure Development Finance Corporation. According to the witness, decision to approve the project and to start work on the project was taken by the State Government of Karnataka as a policy decision. The witness further stated that it is the existing source where the Municipal Corporation is already drawing 1.98 tmc per year and the future planning has been done in anticipation of this Tribunal allotting water to the State of Karnataka.

391.

In question No.7, the attention of the witness was drawn to the statement made in para 16 on page 14 of his

affidavit dated 9.11.2017 and a question was put to the witness as to why the year 2044 AD has been chosen for assessing the future projection of water requirement and why the projection is

not made for commonly used period, say, up to 2050 AD or 2051 AD etc. and why augmentation of full projected requirements of water from new sources has been considered necessary and why quantum of water already available from the existing sources has not been taken into consideration, while assessing the requirement of water from new sources.

Yet other questions

which were put to the witness, were as to what precisely he meant, by the statement “relieve the burden on the existing water of Malaprabha dam which is required for meeting the requirements of command areas, etc.” and did he consider water needs for drinking water supply of Hubli-Dharwad twin cities, which has a highest priority, as a burden.

In answer, the witness mentioned that the year 2044 has been chosen for assessing the future projections since the period of three years is taken for implementation of the project and therefore, from 2041 the year 2044 was selected. The witness mentioned that earlier sources which were existing, were not providing sufficient quantity of water any more and therefore the

water from new source was sought to be tapped but whatever water is available from the existing source i.e. the Neerasagar reservoir is also being taken for the purpose of planning.

943

According to the witness, the drinking water supply of Hubli-Dharwad twin cities cannot, in any manner be considered as a burden.

392.

In question No.8, the attention of the witness was drawn to Table 3 on page 11 of Annexure 61 which is “Report on Drinking water demand of Hubli-Dharwad en route villages, etc., from Malaprabha reservoir (Volume 16) and it was brought to the notice of the witness that it is noticed by the Tribunal that domestic water demand has been estimated for the years 2011, 2021, 2031, 2041, 2051 and then for 2044 but subsequent Tables i.e. Table 3.1 Table 3.1.1 and Table 3.2 whose data are used for finalization of Table No.3, do not include figures for 2044. Having drawn the attention of the witness to the above mentioned inconsistency, it was put to the witness as to why the water requirement figures for the year 2044 AD have been indicated only in Table No.3 and how the figures corresponding to 2044 AD have been arrived at.

The response of the witness was that he had arrived at the

population projection for the year 2041 and 2051 and then he had interpolated between these two years and arrived at the

944

figures corresponding to the year 2044 AD and the requirement of 2044 AD gets reduced and the 7.56 TMC corresponds to the year 2046 AD and to that extent he stands corrected.

393.

document

In question No.9, the witness was confronted with a

titled

“India:

North

Karnataka

Urban

Sector

Investment Program (Tranche 2) – Hubli- Dharwad” prepared by

Karnataka

Urban

Infrastructure

Development

Finance

Corporation for the Government of Karnataka which was

downloaded from the internet and his attention was drawn to what is stated in para 49 of the said document. Having drawn the attention of the witness to the relevant part of the said document, a question was put to the witness as to why and how such huge amount i.e. 40% of the water supply by the water supply network is being allowed to be wasted through leaks into the ground and it was put to the witness that with measures to avoid such wastage, the quantum of water required from new sources can be considerably reduced and a question was put as to why this aspect has not been considered, while assessing the water requirement from new sources and what measures are being taken to avoid such huge wastage of water leaking into the ground.

945

The answer of the witness was that the water distribution and pipelines had been laid very long back and the joints are leaking whereas the pipes are also aged and incrusted, corroded and as such they are subject to leakage. The witness mentioned that the Government of Karnataka, fully knowing this issue, is making all efforts to reduce the water supply losses to the presumable limits by investing huge amount and the replacement of defective pipes completely is being envisaged. The witness, unequivocally stated that already about 1/3 of the population is covered with 24x7 water supply and as such the leakage has been reduced considerably. The witness mentioned that the necessary measures have been taken and also continued to be taken up to reduce the water losses and the above aspect has been considered while assessing the water requirement of the population at 135 LPCD, with 50% unaccounted for water. The witness also stated that after the preventive measures are taken and completed, 25% of additional water would be available for distribution to general public but the same would be within the stipulated limits.

946

This is the sum and substance of the evidence of Shri G.M. Madegowda, RW-3.

Oral Evidence of MW-2

Maharashtra

Shri B.C. Kunjir for the State of

394.

Having discussed the evidence of witnesses examined by the State of Karnataka, now the Tribunal proposes to discuss the evidence of Shri B.C. Kunjir, who was examined by the State of Maharastra as MW-2, on 1.12.2017. In his Examination-in-Chief, the witness has tendered an Affidavit dated 27.10.2017, (Volume 205) sworn by him, and which was produced before the Tribunal on 14.11.2017. The witness had filed four documents along with the Affidavit, which were ordered to be taken on record. In Para 1.0 of his Affidavit dated 27.10.2017 (Volume 205), in Point 1.0 to 1.5, the witness has mentioned about his educational qualifications, expertise, job profile etc. In Paragraph 2.1 the witness has mentioned needs of the State of Maharashtra as projected in Para 6.0 (6.5) on Page 3 of its Master Plan

[Volume 52(D)], as under:

“1.

2.

For irrigation (in basin for 4600 Ha)

Drinking Purpose (in basin)

55.0 Mcum

5.0 Mcum

947

3.

4.

5.

Hydro Power Generation

For Industrial

For Irrigation in Tillari Basin

Total :

15.0 Mcum

25.0 Mcum

80.0 Mcum

180.0 Mcum ”

395.

He has further stated that the State of Maharashtra

has projected the following needs in its Statement of Case

(Volume 27), Para 3.5.2, Page 25:-

“ 1) Irrigation needs of

Maharashtra

2) Drinking water needs in part

of Mandovi river basin

3) Drinking water needs in adjoining uncommanded area of Tilari basin

4) Industrial water needs in part of Mandovi river basin

5) Industrial water needs in adjoining uncommanded area of Tilari basin

6) Provision for future development

7) Evaporation losses 10 %

Grand Total

Say …….

-

-

-

132.27 Mm 3

1.65 Mm 3

2.00 Mm 3

-

-

1.00 Mm 3

1.10 Mm 3

-

-

-

-

25.00 Mm 3

16.30 Mm 3

179.32 Mm 3

180.00 Mm 3 ”

948

396.

According to the witness

the variation of annual

rainfall in the State of Maharashtra, is indicated and it is stated that the maximum annual rainfall of 3000 mm occurs in Western Ghat and sharply diminishes to 700 mm and less in Middle Maharashtra and then increase to 1500 mm in Vidarbha Region.

397.

In Paragraph 2.3 of his Affidavit, the witness stated

that the major problem is with soils and geological formations (mostly laterite) that are porous in nature, which do not hold water, and most of the rain water is drained away either as surface rainfall in monsoons or subsoil flows in post-monsoon period in the month of December, which has historically resulted in monocropping of paddy for most holdings and some scattered plantations of coconut, aracnut, cashew and mangoes.

398.

In Paragraph 2.4 of his Affidavit, the witness has

mentioned that the Government of Maharashtra had introduced

irrigated agriculture in Konkan belt after 1960. According to the witness, in North Konkan the projects such as Surya, Bhatsa were taken up, whereas in South Konkan, Tillari (Dhamne) and Lower Tillari Projects were taken up in 1976 for hydropower generation and irrigation respectively. According to the witness after his

appointment by the State of Maharashtra as an expert witness for the Maharashtra Government, he had visited the basin on 19.8.2017 to know the general status of the basin. In Dodamarg town, he met the Sarpanch of Virdi and from discussions with him, he found that significant number of persons from that area have migrated to Keri village in Goa, for better prospects and some of them have taken up Government jobs, and have settled down there. The witness further stated that he had visited Virdi village and dam site and found that the village Keri is about 5 kms. from Virdi. According to him, his study reveals the total needs of Maharashtra in Mahadayi Basin, along with nearby Tillari valley villages, which has been summarised by him in the Table which reads as under:

“Figures in Mcum

Sl. No.	Particulars	As per Study		
		In Basin (Mahadayi)	Outside Basin Tillari	Total

1.	Irrigation use	80.00	65.00	145.00
2.	Drinking	2.00	3.00	5. 00
3.	Industrial	9.00	3.00	12.00
4.	Evaporati on losses	9.00	9.00	18.00
5.	Hydro Power Generation (Non consumptive)	0.00	0.00	0.00
	Total	100.00	80.00	180.00

950

399.

After referring to the Affidavit filed on 15.9.2015 by Shri S.N. Huddar, expert witness for the State of Maharashtra, it is stated that the yield received in Maharashtra from the catchment area of 92.43 sq.km. would be 274.52 Mcum and 220.91 Mcum at 50% and 75% dependability respectively. The witness has averred that the use in Tillari basin, through a diversion is most natural, because the higher level cultivable fields in Tillari basin, can be then irrigated by gravity canals and this will at least partially compensate for the diversion already made by State of Goa to Mandovi basin from Tillari basin, (261.33 Mcum by State of Goa (Volume-102, Page 3). It is further stated by this witness that as per the availability per capita and availability per unit land both basins are abundant as seen from Maharashtra Water & Irrigation Commission Report, relevant period of which are produced by the witness as Annexure-3 (Colly) with his Affidavit.

400.

In Paragraph 6.2, the witness has mentioned about the usual practice of considering water availability from entire basin to be followed and has mentioned that in fact, State of Goa, has already completed about 20 bandharas, 4 LIS and water

supply schemes in this saline area of 509 sq. kms. The witness mentioned that most of the ferries in the 509 sq. kms. area in Goa, operating in vehicular or human transport, help only to cross the estuaries from one bank to another, and Western part of the 509 Sq. Kms. area in Mandovi basin is densely populated than any other area in the basin whereas the north eastern region i.e. Bicholim tehsil is pastoral. What is stated by the witness is that the claim by the State of Goa for impounding of flows by upstream States might result in increased siltation in estuaries and navigation channels, is in stark contrast to the principles of sediment transport in rivers because reduction in upstream eroding flows always results in less sediment as it is a blocked by dams upstream.

401.

In Ex. MAH-MW2/1 which is a Study in respect of Water Needs of Maharashtra, in Mahadayi Basin, along with nearby Tillari Valley villages is given as under:

952

Figures in Mcum

Sl.No.	Particulars	As per Study		
		In Basin (Mahadayi)	Outside Basin Tillari	Total
1	Irrigation use	80.00	65.00	145.00
2.	Drinking	2.00	3.00	5.00
3.	Industrial	9.00	3.00	2.00
4.	Evaporation losses	9.00	9.00	8.00
5.	Hydro Power Generation (Non consumptive)	0.00	0.00	0.00
	Total	100.00	80.00	180.00

402.

In question No.1 put by the learned Counsel for the

State of Goa, the attention of the witness was drawn to the

statement made by him in Para 5.1 at Page 11 of his Affidavit dated 27.10.2017, as well as MARK-MAH/3 (colly), which is Agreement dated 6.4.1990, entered between the Government of the State of Goa and the Government of the State of Maharashtra. Having drawn the attention of the witness to the relevant detail, the witness was asked as to whether he was in a position to cite or show any clause of the Agreement which contemplated or provided for compensating the share of water of Tillari basin, given to the State of Goa, under the agreement, to be compensated by any water from Mahadayi basin.

953

In answer, the witness stated that he was not aware that any such clause existed in the aforesaid Agreement. The witness f urther stated that the word ‘çompensation’ refers to any derogatory effects, if any, of transfer of water from Tillari caused due to the effect of the said Agreement.

403.

In question No. 2, the attention of the witness was drawn to certain terms of the Agreement, MARK-MAH/3, and it was put to him that the consideration for the water allocated to the State Government under the Agreement is contemplated under Agreement itself, and that the State of Maharashtra need not be compensated further from the water of Mahadayi basin. The witness answered that his answer to question No.1, part (b) had made it sufficiently clear that the word ‘compensation’ does not have basis or any relation to the referred Agreement between the States of Goa and Maharashtra.

404.

After the cross-examination of the witness by the learned Counsel for the State of Goa, Shri Dattprasad Lawande,

learned Advocate General for the State of Goa had made a statement that he had no further question to ask the witness in

954

his cross-examination. Thereafter, the Tribunal asked Shri Mohan V. Katarki, learned Counsel for the State of Karnataka to examine the witness, but he stated that he did not want to cross-examine the witness. Thereupon, few questions were put by the Tribunal.

405.

In question No. 2 put by the Tribunal, attention of the witness was drawn to what he had stated in Para 3.5 at Page 8 of his Affidavit dated 27.10.2017, and the witness was required to explain and give reasons for variation in water demand for different purposes estimated by him and that included in the Further Amended Statement of Case of the State of Maharashtra. The witness responded by stating that “I have no comment to offer to various parts of the question”.

This is the sum and substance of the evidence of Shri B.C. Kunjir, (MW-2).

EVALUATION OF ORAL EVIDENCE LED BY THE THREE PARTY STATES

406.

The Tribunal, now proposes to evaluate the

testimonies of the expert witnesses examined by the three

States, namely the State of Goa, State of Karnataka and the State of Maharashtra.

Findings on Conflicting Results Arrived at by the Experts Relating to Water Availability

407.

The study and examination of the CWC 2003 Report establishes beyond pale of doubt that CWC has estimated yield of Mahadayi basin at 75% dependability, to be 199.6 tmc. This very document together with data mentioned therein and findings recorded regarding estimation of yield has been, relied upon by all the expert witnesses who have been examined on the subject of Hydrology, either wholly or in part. However, the Tribunal is shocked and baffled to find that instead of reaching the same estimation of yield as arrived at by CWC, all the witnesses have given different figures of yield of Mahadayi basin at 75% dependability. The close scrutiny of the evidence tendered by them indicates that Shri Chetan Pandit has primarily reduced the value of the discharge observed at Ganjim site by 19% and reached a different figure of yield than what is mentioned in CWC

Report. Similarly, Prof. A.K. Gosain has taken into consideration the data of longer period for estimation of yield at 75%

dependability. Shri A.K. Bajaj, expert witness examined on behalf of State of Karnataka has virtually adopted the yield figure arrived at by Prof. A.K. Gosain, without making any in-depth study at all. Shri S.N. Huddar, expert witness examined by the

State of Maharashtra has adopted the figure mentioned in CWC 2003 Report but has added the input from Tillary basin. That is how he has estimated the highest yield of Mahadayi basin at 75% dependability. Shri S.T. Nadkarni, expert witness examined by the State of Goa has worked out yield of Mahadayi basin at 75% dependability for various sub-basins of Mahadayi. Therefore, when such approaches are adopted by expert witnesses which are not rational, it becomes highly difficult for the Tribunal, to place reliance on the evidence tendered by the expert witnesses. It may be mentioned that after the oath was administered to each expert witness by the Tribunal before recording of evidence, each witness was in no uncertain terms, was informed by the Tribunal that he was an officer of the Tribunal and therefore he should, to the best of his capacity, assist the

Tribunal, in arriving at true and correct figure of yield of river Mahadayi basin at 75% dependability. However, the Tribunal notices with pain that all the expert witnesses have failed to

discharge their duties to assist the Tribunal to enable it to arrive at correct figure of the yield of Mahadayi basin at 75% dependability.

It is well to remember that all the expert witnesses are remunerated one. They have not only been engaged by the respective States to boost up their respective cases, but have deposed in a manner which favours the State concerned, which has appointed him and requested him to depose before the Tribunal.

It would not be out of place to mention here that Shri Chetan Pandit, deposing as an expert witness on behalf of the State of Goa, has filed four affidavits. In the first affidavit filed on 15.09.2015 (Volume 165), yield of Mahadayi Basin at 75% dependability was not mentioned at all. Shri Chetan Pandit has filed another affidavit dated 4.8.2016 (Volume 191), wherein the yield of Mahadayi Basin at 75% dependability was estimated to be 154.4 tmc for the total area of 2032 sq.km. and at 115.7 tmc for the catchment area admeasuring 1523 sq.km. During the course of his cross-examination, he has substituted the yield

figure on the ground that there was a computer mistake. He has

substituted the figure of 154.4 tmc by 151.47 tmc in respect of yield of Mahadayi Basin at 75% dependability for the total area of 2032 sq.km.

In the third Additional Affidavit of Examination-in-Chief, filed on 12.9.1996 (Volume 192), Shri Chetan Pandit has not given any figure of yield of Mahadayi Basin at 75% dependability.

In the fourth Additional Affidavit-in-Evidence, filed by Shri Chetan Pandit on 4.1.2017 (Volume 196), he has given the yield at 75% dependability at particular project locations, but has not mentioned total yield of Mahadayi Basin at 75% dependability.

Prof. A.K. Gosain, expert witness, examined on behalf of the State of Karnataka, has filed his first affidavit dated 15.09.2015 (Volume 166), wherein he has estimated the yield of Mahadayi Basin at 75% dependability to be 206.14 tmc. Prof. Gosain, expert witness, has filed Additional Affidavit to be treated as Examination-in-Chief on 15.11.2016 (Volume 193), but in the said affidavit, particulars about yield assessment at projects sites are provided and not the figure of yield of Mahadayi Basin at 75% dependability.

959

Prof. A.K. Gosain filed further Affidavit on 24.3.2017 (Volume 197) and by the said Affidavit he has properly affirmed and verified his own Affidavit sworn on 12.9.2015. Prof. A.K. Gosain has further filed Affidavit on 11.05.2017 (Volume 198), wherein only gross yield for entire Mahadayi Basin, taking into consideration the years beginning from 1928-29 to 2012-13, using revised regressing equation, is shown to be 202.55 tmc at 75% dependability.

Shri A.K. Bajaj, deposing as an expert witness on behalf of the State of Karnataka has filed his Affidavit on 30.12.2016 (Volume 194), in which, after placing reliance on the yield at 75% dependability as mentioned in CWC (2003) Report, he has used the yield of Mahadayi Basin at 75% dependability to be around 200 tmc for his water balance study.

Shri S.N. Huddar, deposing as an expert witness on behalf of the State of Maharashtra, has filed Affidavit on 15.09.2016 [Volume 163(a)] and he has estimated the yield of Mahadayi Basin at 75% dependability to be 5913 Mcum (208.73 tmc).

Shri S.T. Nadkarni, deposing as an expert witness on behalf of the State of Goa, has filed Affidavit on 14.11.2017 (Volume 208), wherein, after dividing Mahadayi Basin into Sub-basins, he has estimated yield for each Sub-basin and thereafter, he has arrived at the yield figure at 75% dependability to be 3283.30 Mcum (115.9 tmc). However, he has adopted the value of yield estimated by Shri Chetan Pandit for the entire basin without making his independent study.

It may be mentioned that Shri Chetan Pandit in his Affidavit dated 4.8.2016 (Volume 191) on page 39, has stated that every catchment invariably presents a different challenge in terms of availability of data and the accuracy of that data. In view of this statement of fact made by Shri Chentan Pandit, the exercise undertaken by Shri S.T. Nadkarni to determine the yield on the basis of Sub-divisions of Mahadayi Basin by using the regression equation developed by Shri Chetan Pandit becomes redundant and cannot be acted upon.

In view of the above stated state of affairs, the Tribunal is left with no option but to carry out its own assessment for the

purpose of estimation of yield of Mahadayi Basin at 75% dependability.

Further, in the Statement of Case, filed by the State of Goa, the yield of Mahadayi Basin at 75% dependability is mentioned to be 108.72 tmc, whereas in the Statement of claims, filed by the State of Karnataka, the yield of Mahadayi Basin at 75% dependability is estimated to be 199.6 tmc.

The State of Maharashtra by filing Statement of Case on 02.01.2013 (Volume 27), has estimated the yield of Mahadayi Basin at 75% dependability to be 3164 Mcum (111.7 tmc).

In its amended Statement of case, filed on 2.4.2014 (Volume 74), the yield at 75% dependability is maintained as the same as mentioned in Volume 27. The State of Maharashtra has further filed Amended Statement of Case on 20.4.2015 (Volume 127) and maintained the same figure of annual yield.

However, the Tribunal finds that the expert witnesses, examined by the three States, have presented different figures of yield of Mahadayi Basin at 75% dependability. Thus, there is

variance between pleading and proof. A party is expected and is bound to prove the case as alleged by him. This is in accordance with the main principle of practice that a party can only succeed according to what was alleged and proved secumdum allegata et probate. The ordinary rule of law is that evidence should be only on plea properly raised and not in contradiction of the plea. A party cannot be allowed at the trial to change his case or set up a case inconsistent with what he has alleged in his pleading, except by way of amendment of the pleading under Order 6 Rule 17 of the CPC. Finding of a Court or Tribunal cannot go beyond pleadings and no amount of evidence can be looked into upon a plea which was never put forward. In the absence of any plea or issue, no evidence can be considered to be relevant and cannot be taken into consideration. A party cannot be allowed to lead evidence in contradiction of what has not been pleaded in the pleading. The Rule of secundum allegata et probate is based mainly on the principle that no party should be taken by surprise, by the change of case, introduced by the opposite party. A variation which causes surprise and confusion, is always ooked

upon with considerable disfavour. The principle of ‘variance between pleadings and proof’ is very much attracted in the matter of appreciation of evidence. A party-litigant cannot be

allowed to take inconsistent position in Court, to play fast and loose, to blow hot and cold, to approbate and reprobate to the detriment of the opponent. This doctrine applies to successive stages in the same proceedings.

Here, in this case the Tribunal finds that there is great variance between the pleadings relating to yield of Mahadayi Basin at 75% dependability and the evidence adduced regarding yield of Mahadayi Basin at 75% dependability. When the Tribunal is faced with such a problem, the Tribunal is of the opinion that the higher figures of yield of Mahadayi Basin at 75% dependability mentioned by different expert witnesses will have to be taken into consideration, with a pinch of salt and cannot be blindly relied upon.

In the light of above stated principles, the evidence adduced by the three party-States through expert witnesses will have to be evaluated.

This Tribunal has heard the learned Counsel for the parties at length and in great detail. The Tribunal has not only considered the lengthy pleadings of the parties but has taken into account

964

the written submissions, notes of argument and the law cited at the Bar. The written submisions and the notes of argument are not dealt with in detail in order to see that the Award which is otherwise lengthy, is not overburdened.

408.

The same becomes evident, if one refers to Table I prepared by the Tribunal, which reads as under:-

Sl.

No.

1.

2.

Sources

Water availability at

75% Dependability

: 208.73 tmc

Affidavit of Shri S.N. Huddar

Statement of Prof. A.K. Gosain

during cross examination

Report of Prof. Gosain of

September 2015, Case II

Report of Prof. Gosain of

September 2015, Case I

Report of Prof. Gosain of

May 2017, Case II

Statement of Claims of the

State of Karnataka

Report of Prof. Gosain of

May 2017, Case I

: 206.17 tmc

3.

: 206.14 tmc

4.

: 204.24 tmc

5.

: 202.55 tmc

6.

: 199.60 tmc

7.

: 198.42 tmc

965

8.

Affidavit of Shri Chetan

Pandit

Statement of Shri Chetan

Pandit during cross

examination

: 154.40 tmc

9.

: 151.47 tmc

10. Statement of Case of the

State of Goa

: 145.05 tmc

Note-1:

Shri Nadkarni has made assessment of Sub Basin wise for the area of 1523 sq.km. as 115.99 tmc (Ref. 13), which is slightly more than the estimate of 115.7 made by Shri Chetan Pandit and Shri Nadkarni has stated that he agrees with the calculation of yield

made by Shri Chetan Pandit (Ref. para 8 above) i.e. 154.40 tmc relating to whole Mahadayi basin.

Note-2:

The State of Maharashtra has not made separate assessment of water availability for entire Mahadayi Basin and has relied upon the testimony of Shri S.N. Huddar.

966

409.

Thus a bare glance at the above mentioned table, makes it evident that there are serious conflicts of opinion between the same and/or between more than one experts. Under the circumstances, a vital question which arises for consideration of the Tribunal is as to how the evidence of expert witnesses should be evaluated and what should be the approach of the Tribunal, in case when conflicts of opinion between experts are found to be substantial in nature by the Tribunal.

Principle Governing Appreciation of the Oral Evidence given by the Witnesses on Hydrology.

410.

Tribunal notices that Section 45 of the Evidence Act, 1872, deals with the opinion of third person, when delivered. It is well settled that it is not the providence of an expert to act as judge or jury. An expert is not a witness of fact and his evidence is really of an advisory character. The duty of an expert witness is to furnish the Court with the necessary scientific criteria for testing the accuracy of the conclusion, so as to enable the Court

to come to an independent judgment. The law of evidence is designed to ensure that the court considers only that evidence which will enable it to reach a reliable conclusion. The expert

opinion has to be well reasoned. He must make available to the court, all materials which induced him, to opine in a particular direction. The expert evidence is merely a piece of evidence. A judge of fact will have to consider that evidence, along with the other pieces of evidence. Expert's evidence by its very nature is only an opinion evidence. An expert only aids and helps the Court by his opinion. The expert does not decide. He only helps and assists the Court to decide. It hardly needs to be emphasized that the opinion of an expert cannot substitute or take the place of proof in a trial. An opinion of an expert is not beyond the judicial scrutiny. In a given case, the Court need not accept the opinion given by an expert, when other reliable evidence in proof of a fact in issue is available. The essential principle governing the expert evidence is that an expert is not only to provide reasons in support of his opinion, but the results should be directly demonstrable. The Court is not to surrender its own judgment to that of the expert, or its authority to a third party, but has to assess the expert evidence like any other. If the report of an expert is slipshod, inadequate or unsatisfactory, then his opinion

is of no use. Where several experts give the evidence, expected in favor of the parties by whom they are called, it can carry a little weight, when one expert is contradicted by the other. When the

court finds that there is conflict of opinions, rendered by several experts, opinion of any one of them cannot be preferred on conjectural reasons. What is important to keep in mind is that the expert evidence produced by an interested party, may have certain amount of unconscious bias in favour of that party. When an expert is produced by one of the parties, but the said expert fails to produce any book or literature in support of his conclusions, the conclusions cannot be relied upon merely on the face of it. Where both the parties to the dispute produce their expert witnesses supporting their respective claims, such contradictory reports, which do not lead to any reasonable conclusion, are liable to be discarded. The opinion of an expert engaged by a party suffers from an inherent fact that it is given by remunerated witness. He knows beforehand as to why he has been called as a witness, and what a party calling him wishes to be proved. It is not improbable that he has an unconscious bias in favour of the party, who calls him for tendering the evidence before a court.

411.

These are the broad principles, on the touchstone of which, the evidence of an expert has to be appreciated. However, as far as Hydrologists are concerned, there is no reported case,

which guides this Tribunal as to in which manner the testimony of a Hydrologist should be assessed. Notwithstanding, the absence of law laying down principles as to how the evidence of a Hydrologist should be evaluated, the Tribunal finds that it would be worthwhile to refer to some portions of a book, titled as " **Settlement of International and Inter-State Water Disputes in India" authored by Dr. B.R. Chauhan,** whichdeals with the principles to be borne in mind, while appreciating the evidence of a Hydrologist. The said book was published in 1992 by the Indian Law Institute through its Director Mr. P.M. Buxi, New Delhi. From the Foreword written on January 26, 1992 by Dr. Upendra Buxi, a renowned Jurist, who was then the Honorary Director of Water Law Project, indicates that Dr. Buxi had commended that had prepared and presented " a lucid work for serious study for all concerned for the human rights reason that it would escalate our capabilities as citizen – scholars to mediate and shape public choice which will enable, the nation, to adjust to, in lamented Roscoe Pound's S triking Phrase, conflict s of interest with "least friction and w aste". " As per the Foreword written by the eminent

jurist Dr. Buxi, “ Dr. Chauhan is a scientific leader in this field, acknowledged world-wide ” .

970

The distinction between *de lege-lata* and *de lege-ferenda* is explained in the treaty prepared by Dr. Chauhan in Chapter IV, at page 21, which relates to 'Theories on Sharing of International and Inter- State Water Resources'.

The relevant part of Chapter IV, is reproduced as under:

"Distinction between *de lege-lata* and *de lege-ferenda* :

Sometimes, guided and overwhelmed by the considerations of narrow self-interest, a scholar places himself in the position of one of the disputant parties and as such starts emphasizing or defending a particular viewpoint so as to safeguard the interests of, say, the lower riparian or the upper riparian, as the case may be, and in that exercise he tries to justify or establish a particular theory or doctrine. In this manner the concerned scholar wraps up the law of his imagination, namely, the law as it ought to be or *de lege-ferenda* ,in the motivated logic and tries to depict it as the prevailing law, viz. *de lege-lata* .Such an exercise is very harmful not only to the cause of

research and legal knowledge but also can create havoc if somewhere the norms so suggested, or mixed up, find application in the settlement of actual water dispute.”

971

Evaluation of Oral Evidence of AW-1 Shri Chetan Pandit for the State of Goa

412.

Shri Chetan Pandit, AW1, has been examined, as an expert witness by the State of Goa on the topic of “Hydrology - Availability of Water”. Shri Chetan Pandit says that he is a Hydrologist by profession, and has worked with the Central Water Commission for more than 35 years. According to him he has also advised, the State of Goa, on various aspects, including formulation of its water policy. He claims to have, extensively visited the Mahadayi Basin in the State of Goa, as well as the spots of origin of the River Mahadayi in Bhimgad Sanctuary in Khanapur Taluka, in the Belgaun District, and other Mahadayi Basin areas, in Karnataka. According to him the State of Goa had requested him to conduct a study on water availability in the Mahadayi Basin and to depose before the Tribunal. That is how, he claims to have prepared his study and affidavit.

413.

Shri Chetan Pandit, has submitted his study, before

the Tribunal as Report dated 3.8.2016 (Volume 191).

972

414.

The Tribunal finds that the averments made in the said study, are general in nature, and no specific reference to standard tax of approved guidelines etc. for assessment of yield of Mahadayi Basin, by Shri Pandit, is mentioned therein. Further, the Tribunal notices that along with the said affidavit, no documents were annexed at all. Shri Chetan Pandit tendered an affidavit of examination-in-chief dated 4.8.2019, (Volume 191), before the Tribunal. Along with his affidavit Shri Pandit has annexed an Annexure-A, which is yield study of Mandovi (Mahadayi) Basin. The yield obtained by Shri Pandit is mentioned on Page 58 of Table 34, of his yield study of Mahadayi Basin. The same is as under:

Table 34A- Yield in Mahadayi Basin

Yield		MCM	TMC
Runoff over entire catchment Area 2032 SqKm	50% Dependable	5039.8	178.0
	75% Dependable	4372.4	154.4

Usable Yield. Catchment Area 1523 SqKm	50% Dependable	3777.3	133.4
	75% Dependable	3277.2	115.7

415.

Shri Chetan Pandit has filed yet another affidavit of examination-in-chief dated 9.9.2016 which was tendered before

the Tribunal on 12.9.2016 (Volume 192). Along with his affidavit dated 9.9.2016, Shri Chetan Pandit has annexed an Annexure B, which is to be found on running pages 100 to 139 of his affidavit dated 9.9.2016. The witness has produced extract of the project approved in 2016, by the State of Karnataka within the territory of State of Karnataka as Annexure “C”, titled “Projects Approved in 2016”, which is to be found on pages 140 to 145 of his Additional Affidavit.

Further, he has produced an Annexure D,
which is at Page 146 of his additional affidavit of examination-in-chief tendered before the Tribunal on 12.9.2016. Annexure ‘D’ is the photo copy of Flood Control and Utilization of Water in Bennehalla Basin, a Scientific Proposal. He has also filed his Additional Affidavit-in-Evidence dated 04.01.2017 (Volume 196).

416.

From the affidavit and the documents produced by
Shri Chetan Pandit, the Tribunal finds that, he has used the observed data of rainfall, very specifically identified rain-gauge station, in and around, the basin and the discharge data,

observed by CWC gauging station, at Ganjim in the analysis, which are highlighted by him in his Report of August 2016 (Volume 191), and January 2017 (Volume 196). The Tribunal also finds that Shri Chetan Pandit has used, the rainfall data of 42

years from 1964 to 2005, in his Report, which is evident from what is stated in Paragraph 11 on Page 50 of Volume 191. In Para 28 on Page 12 of Volume 191, this witness has stated that there is not a single CWC gauging station on many significant tributaries of Mahadayi viz. Ragda, Kotni Nadi, Bail Nadi and Surla Nadi. He has stated that the rivers on which projects have been proposed by the State of Karnataka and Maharashtra are un-gauged. Further, the Tribunal notices that non-establishment of gauging stations at significant tributaries and non-availability of observed discharge data at such tributaries, is not found to be, a hurdle and /or a constraint, for assessment of yield of Mahadayi Basin, and its tributaries, or for identified project sites. This has become apparent from the reply given by Shri Chetan Pandit to question No.159 put to him

wherein he,

by the Tribunal on 6.10.2016,

inter alia, stated “also I do not recommend

runoff relationship for small catchment

developing rainfall

because, as the catchment gets smaller and smaller, the relationship becomes less and less stable. Finally, I would also add that, when I examined the Report, earlier prepared by others, I had seen, that they too have focussed only on the Ganjim data. Therefore, while my study is independent, using only Ganjim data, would make it easier to compare the results".

975

417.

In Para 19 at Page 8 of his affidavit (Volume 191), Shri Pandit has reported the result of his study, wherein the water availability of Mahadayi Basin has been indicated by him as under:

Runoff over entire catchment area of
2032 sq.km at 75% dependability

Runoff over entire catchment area of
2032 sq.km at 50% dependability

418.

=154.4 tmc

=178.0 tmc

However, in answer to question No.154 put to Shri Pandit, by the Tribunal on 5.10.2016, he has admitted that due to some software error found in the 2003 version of Microsoft Office, the valuation indicated in his affidavit (Volume 191) needed corrections and he has stated that, the re-assessed value of the water availability for the entire Mahadayi Basin, is as under:

Runoff over entire catchment area of =151.47 tmc

2032 sq.km. at 75% dependability

Runoff over entire catchment area of =175.16 tmc

2032 sq.km. at 50% dependability

976

419.

Thus the Tribunal is of the opinion that due care was not taken by Shri Pandit when he reported the results of his study in his affidavit (Volume 191).

420.

Another important aspect of the matter is that, Shri Pandit has not included detailed analysis of the discharge data observed at Collem in his Report of August 2016 (Volume 191). In Para 13 on Page 51 of Volume 191, Shri Pandit has mentioned that a small kink is seen around 1987 and then again around 2000 but the Tribunal finds that no explanation is offered by Shri Pandit as to why kink of 1987 was found.

421.

With a view to ascertaining whether Shri Pandit had examined, all facts, and had undertaken proper test, before assuming that necessary correction factor, for converting surface velocity of flow measured by float, into mean velocity was not applied by CWC, the Tribunal had put question No. 176 to him which is as under:

“Q .No.176: Have you examined the observed data sheet of Central Water Commission (CWC) in respect of observations during the period from 1979 to 2000 to check whether coefficient as prescribed in ISO 748:2007/IS-1192:2013 (MARK-14) has been applied as

multiplication factor by CWC to covert the surface velocity observed by float measurement into mean velocity or not?"

422.

The reply given by him was that he had not checked the CWC's original data at the site. The Tribunal further finds that in view of the averment made by Shri Chetan Pandit in his Report of 2016 (Volume 191), and his reply to various questions, the contention of the State of Goa that there was no actual gauging of (a) the river Mahadayi, covering the entire basin at each of the tributary and (b) rain to assess the complete yield of the river, has no substance.

423.

On the basis of averments made by Shri Chetan Pandit in his Report of 2016 (Volume 191) and his replies to various questions, it is evident that he has considered the existing rain gauge stations as adequate and has used the observed data of these stations, with or without corrections/modifications for the purpose of assessment of yield of Mahadayi river basin, as also

the yield at various project sites within the Mahadayi basin. Thus, the contention of the State of Goa that the data available at various observation Stations, particularly the Hydro-

meteorological and Hydrological observation Stations, are not reliable and adequate, cannot be accepted.

424.

Further, the case of the State of Goa that the gauge data collected at Ganjim site is unreliable, is not fully established in view of the averments made by Shri Chetan Pandit, in his affidavit and Report. Further his affidavit and Report indicate that the State of Goa had excluded initially 1050 sq.km, out of total catchment area of 2032 sq.km, for the purpose of, estimation of water availability, at different dependability, with specific Issue No. 24 framed by the Tribunal. The Tribunal notices that, this exclusion of 1050 sq.km has been discussed in Para 15 at Page 55 of his Report of August 2016 as under:

“Thus in this case of Mandovi River basin while the total yield may be estimated for a catchment area of 2032 sq.km, usable yield has to be estimated only on the area 1523 km 2 being = 2032-509 km 2 .”

425.

The above statement of Shri Pandit presents a clearly

different scenario from what is reflected in the specific issue framed for determination i.e. Issue No. 24, which is based on Para 179E, on Page 217, Para 179L, on page 221, and Para 179M on Pages 221-222, of the Statement of the Case of the State of

Goa (Volume 131). The Tribunal notices that question No. 173 put to Shri Chetan Pandit related to meaning to be ascribed to words “definition of yield”, as given in Indian St andard Code, or that included in the Report of the Cauvery Water Disputes Tribunal. He was also requested to give reasons for dis-agreeing with the definition of yield, as given in Indian Standard Code, or that included in the Report of Cauvery Water Disputes Tribunal. The Tribunal notices that in his reply Shri Chetan Pandit did not specifically convey, his dis-agreement with the definition of yield, as given in the Indian Standard Code or that included, in the Report of Cauvery Water Disputes Tribunal.

The Tribunal finds that from the averments made by Shri Pandit, in his affidavit and Report, it is evident that the contention of the State of Goa that “for the purpose of estimation of water yield at different dependability, an area of 1050 sq.km. is required to be excluded” cannot be accepted. The Tribunal finds that the approach for the study adopted by Shri Pandit to estimate the yield of Mahadayi Basin, is broadly similar to the approach followed by Central Water Commission (CWC) in

its Report of 2003 (Volume 15) and those followed by Prof. A.K. Gosain, an expert witness of the State of Karnataka, in his Report

of September 2015, (Volume 166), and subsequently in his Report of May 2017, (Volume 198-198A). The Tribunal further finds that various steps followed for completion of the study by Shri Pandit, Prof. Gosain and CWC are also the same, except for two steps, namely, (a) catchment area for the estimation of yield, and (b) correction for discharge observed by Float Method, which constitutes part of the Report of Shri Chetan Pandit only.

426.

On appreciation of evidence of Shri Chetan Pandit, the Tribunal finds that Shri Pandit, has estimated the average rainfall for the catchment, upto proposed project site, by using the rain gauge station, in and around the basin, using Arithmetic Means Method. As a matter of fact, the Tribunal notices that, rainfall data of only one rain gauge station has been used, by Shri Pandit, for most of the project sites.

427.

It is to be noticed that the term ‘annual runoff’, mentioned in Issue No. 10, has not been used by Shri Pandit in his affidavit and Report of August 2016 (Volume 191) instead, Shri

Chetan Pandit has used the phrase ‘runoff of entire catchment’, or ‘total yield’, and ‘usable yield’. Shri Pandit has, accordingly, estimated the runoff, over the entire catchment and has worked

out the usable yield at 50% dependability, and 75% dependability. What is noticed by the Tribunal is that in his affidavit and Report of August 2016, Shri Pandit has not at all used the term ‘natural safe yield’ which is the case of the State of Goa included in the pleadings filed by it.

428.

During the course of giving reply to question No. 155, it was stated by Shri Chetan Pandit that he had used 2003 version of Microsoft, which includes a programme called ‘Excel’, for Arithmetic operation, and software errors have been found in the two versions, namely INTERCEPT and SLOPE but he had used the said software in his good faith and completed his Report.

429.

From the testimony of Shri Chetan Pandit, the Tribunal finds that there are considerable variations in respect of yield i.e., runoff over catchment area. While the 75% dependable runoff, is stated to be 145.05 tmc in the Statement of Case of the State of Goa, on the basis of which Issue No. 10 was framed, Shri

Pandit in his Report of August, 2016 (Volume 191) has indicated a figure of 154.4 tmc. Even revised figure of 151.47 tmc, indicated by Shri Chetan Pandit, during his cross-examination, is found to be considerably more than the value mentioned in Issue No.10.

Thus, the Tribunal is of the firm opinion that the Issue No. 10, as it is in its present form, has not been supported by Shri Pandit, either with reference to specific terms used or in respect of the values of 75% dependable yield, or 50% dependable yield. Further, the Tribunal finds that the application of correction by Shri Pandit, for discharges observed by Float Method, is found to be uncalled for, since the correction for converting the velocity measured by using Float into Mean velocity, constitutes a part of the routine process, to be performed during field observation and computation, before according the measured discharge data for the day.

430.

From the facts that have emerged during the course
it is noted by the
of cross-examination of Shri Chetan Pandit,
Tribunal that there are various instances of inconsistencies in the data used by him, as also in the data processed by him. The Tribunal notes that the procedure for development of rainfall-runoff model has not been strictly adhered to by Shri Pandit, as

laid down in the (i)

“Guidelines for Preparation of Detailed

Projects Reports of Irrigation and Multipurpose Projects” of the

Govt. of India, Ministry of Water Resources, published in 2010,

which is MARK- 5 (ii) “Introduction to Linear Regression (Third

983

Edition) by Douglas C. Montegomery, Elizabeth eth A. Peck, and G. Geoffrey" Vining (MARK - 31) (iii) "Chapter A3 Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsh of Book 4, (iv) Hydrologic Analysis and Interpretation of the United States Geological Surveys (USGS)" (MARK - 32), and (v) "Training modul SWDP – 37 – How to do hydrological data validation using regression

prepared under Hydrology Project by DHV

Consultants BV & DELFT HYDRAULICS" (MARK -3).

431.

One of the major flaws found by the Tribunal in the testimony of Shri Chetan Pandit, is the procedure adopted by him for estimation of water availability, which relates to applying a correction factor of '0.84', to the d ischarges observed by CWC at Ganjim site, for the period from 1979 to 2000, thereby, reducing the quantum of observed runoff. The Tribunal finds that this again, on the part of Shri Pandit, was based on his assumption that the prescribed correction factor to convert surface velocity to mean velocity, at the time of discharge observation by 'Float

Method', was not applied by CWC, while computing the daily discharges at the site.

However, the Tribunal finds that his assumption is factually incorrect, sinc e Surface Velocity' was already converted into the 'mean velocity' by applying a

correction factor of “0.89” by CWC, which is apparent from “Velocity Observation by Float dated 3.7.01 prepared by CWC at Site No.25A, Ganjim” (MARK -15 colly). Thus the process of reducing the value of the annual runoff by Shri Pandit, and using this reduced value, of runoff, for development of rainfall runoff model is erroneous and unwarranted.

432.

Under the circumstances the Tribunal is of the firm opinion that, the assessment of water availability of Mahadayi River Basin, made by Shri Chetan Pandit, (which is based on a model developed by him using the runoff data modified on the basis of an erroneous assumption resulting into under estimation of runoff), cannot be considered as reasonable and reliable. The Tribunal records a finding of fact that the assessment of water availability, as projected by the State of Goa, and, the one reported by Shri Pandit in his Report, are apparently on lower side and it is not safe to accept the same.

Evaluation of Oral Evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka

433.

Prof. Gosain, RW-1, expert witness for the State of Karnataka has filed 3 separate Affidavits-in-Evidence dated

985

September 12, 2015, November 15, 2016 and May 11, 2017, which are given Volumes No. 166, 193 and 198, respectively, by the Tribunal. In his affidavit dated 12 th September, 2015, Prof. Gosain has also attached a Study conducted by him, titled as “The Yield Study of Mahadayi Ba sin”. The said Study dated 12th September, 2015, has been annexed by him to his affidavit as ‘Annexure B’, and the conclusions of the said Study are enumerated in paragraph 7 therein.

434.

A bare glance of the said Study makes it evident that Prof. Gosain has relied on the same data, that has been used by the CWC, and that he has also relied on IMD data.

435.

After going through the affidavits and Reports of Prof. A.K. Gosain, RW-1, Expert Witness of the State of Karnataka, the Tribunal finds that, he has estimated different values of water availability of Mahadayi Basin, in his Report of September 2015 (Volume 166), and Report of May, 2017 (Volume 198), as under:

Sl. No.	Reference Document	Water availability at 75% dependability	Water availability at 50% dependability
1.	Report of September 2015 of the Expert Witness (Case-I)	204.24 tmc	224.61 tmc
2.	Report of September 2015 of the Expert Witness (Case-II)	206.14 tmc	223.20 tmc
3.	Report of May 2017 of the Expert Witness (Case-I)	198.42 tmc	215.59 tmc
4.	Report of May 2017 of the Expert Witness (Case-II)	202.55 tmc	216.89 tmc

436.

With regard to the findings and conclusions of his

Study, Shri Gosain has stated as under:-

“It may be observed that 50% and 75% dependable

analysis gross yield of Mahadayi Basin, works out by using

the extended data with the old R-R Model is not very different from the one, obtained by revising the R-R Model, after incorporating the additional runoff observations. Hence, it is recommended to use 50% and 75% dependable gross annual yield for Mahadayi Basin as 6321 Mcum (223.20 tmc) and 5838 Mcum (206.14 tmc) respectively, since it is the outcome of a correct procedure."

987

437.

Further, in his Additional Affidavit-in-Evidence dated 15 th November 2016, (Volume 193) Shri Gosain has conducted a “Supplementary Study of Yield Assessment at Project Site”, which is annexed to his Affidavit as ‘Annexure A’. This Report is limited to the assessment of water availability in respect of projects, planned and proposed in the Mahadayi Basin and situated within the territory of the State of Karnataka. He has used the proportional area method with the rainfall factor of nearest observation rainfall to the Main Gauged Sub Basin rainfall. The results of Supplementary study obtained by Shri Gosain are as under:-

Projects	50% dependability	75% dependability
Kalasa Dam	4.6 tmc	3.8 tmc
Bhandura Dam	4.6 tmc	3.7 tmc
Kotni Dam Site	23.9 tmc	19.4 tmc

Kotni Dam Site (Independent catchment)	13.4 tmc	10.6 tmc
Bailnadi Dam (Diversion)	4.4 tmc	3.7 tmc
Irti Dam (Diversion)	1.2 tmc	0.9 tmc
Irti Pickup Dam (Independent catchment)	1.5 tmc	1.2 tmc
Diversion of Kotni Basin		
1. Kalta-Palna	3.0 tmc	2.5 tmc
2. Diggi Diversion	2.1 tmc	1.8 tmc
3. Viranjole	1.0 tmc	0.8 tmc

988

438.

Shri Gosain has filed an Affidavit-in-Evidence dated 11 th May, 2017, (Volume 198), titled as “Affidavit in Support of the Analysis of Yield of Mahadayi Basin taking Rainfall Data from 1928-29 and 2012- 13”. Shri Gosain has attached the said Analysis to hi s said affidavit as ‘Annexure A (Colly.)’

439.

Along with the Affidavits-in-Evidence dated 12.9.2015 (Volume 166), 15.11.2016 (Volume 193) and 11.5.2017 (Volume 198), respectively, Shri Gosain has also relied upon the following documents:-

(a)

Bio Data, enclosed which is affidavit dated 12.9.2015 as ‘Annexure A’ to the said affidavit.

(b)

Report dated 12.9.2015 with Appendices I to XIII, marked as Exh. KAR-RW1/2(Colly.)

(c)

Supplementary Study for Yield Assessment at Project

Sites, at ‘Annexure A’, to his affidavit dated 15.11.2016 (Volume 193), marked as EXH. KAR-RW-1/3.

(d)

Letter dated 3.10.2013, issued by the Office of the Chief Engineer Water Resources Department, Govt. of

Karnataka, along with a brief note on the subject, marked as MARK-KA/5(Colly.).

(e)

Documents containing the proceedings of the Govt. of Karnataka, and also order dated 9.10.2015, approving the appointment of Shri A.K. Goyal, w.e.f. 12.8.2015, marked as MARK-KA/6.

(f)

The documents produced by the witness about his visit to the Mahadayi Basin, from 5.11.2015 to 7.11.2015, marked as MARK-KA/8.

(g)

Data for the Stations, i.e. Valpoi, Ponda, Panjim, Mapuca, Sanguem, Khanapur, Kanakumbi, Jamagaon and Amagaon for the years from 2001-2002 to 2012-13, marked as MARK-KA/9 (Colly.).

(h)

Analysis, along with Annexures I to IX dated 9.5.2017, prepared by him, which is marked as Exh. KAR-RW-1/6

(Colly.), which is referred to his Report dated 9.5.2017 (Vol.198).

(i)

Hard copy of the data and the computations, made for RR Relationships, with and without, the omitted data of 1979-80, along with the subsequent computation of the yield, marked as Exh. KAR-RW1/7.

990

440.

Shri Gosain was cross-examined in great detail and length, on behalf of the State of Goa, by Shri Atmaram N.S. Nadkarni, learned Senior Counsel, and by Shri Dattaprasad Lawande, learned Advocate General of the State of Goa. The cross-examination of the witness was with reference to, inter alia, his Affidavits-in-Evidence and the documents produced by him.

441.

From the cross-examination of this witness, it becomes evident that Shri Gosain was asked questions, virtually, on every topic and issues included in his Study, to gain clarity and to understand what is stated in his Reports. Certain questions were also put to Prof. Gosain by the Tribunal.

442.

A fair reading of his testimony makes it very clear that he is a knowledgeable and competent expert. However, in the instant case, the Tribunal has found some inconsistencies, in the studies conducted by Prof. Gosain, as well as the inconsistencies

emerging from the answers given by him in his cross-examination, which are basic in nature, and go to the root of the matter.

991

443.

The

Tribunal

proposes

to

point

out

certain

fundamental inconsistencies, which are found in the testimony of Shri Gosain. These are as under:-

(a)

Prof. A.K. Gosain, has not made use of the observed discharge data at Chapoli Site of the State of Karnataka or that of any other Site of the State of Goa or the State of Maharashtra. The Tribunal finds that the details of this specific procedure for the assessment of water availability made at Haltar Dam, Kalasa Dam, Kotni Hydro-Power Dam, Bailnadi Dam Site, Bhandura Dam Site, the entire catchment in

Karnataka and Ganjim G&D Site of main river, Khandepar at Collem G&D Site and entire catchment up to the mouth of the sea of Goa are neither described in the Amended Statement of Claims of the State of Karnatakla (Volume 129) or in any other document, filed by the State of Karnataka. It is worth observing that the available observed discharge data at Chapoli Site maintained by the State of Karnataka, has not been used, even for assessing the yield at Kotni Dam Site, which is a little surprising. The

observed discharge data at Chapoli is also not taken into account, in consistency checks, etc.

(b)

On 18.5.2017, Shri Gosain volunteered that when he worked out the yield, by using the R-R Relationship derived after incorporating the omitted year of 1979-80, as given at page 4 of the document Exh.KAR-RW-1/7, and the re-computed yield, then the 75% dependable yield of Mahadayi Bain comes out to be 206.17 tmc and at 50% dependable yield comes out to 223.06 tmc, versus the earlier results, wherein the 75% dependability yield was 206.14 tmc and 50% dependability yield was 223.20 tmc.

(c)

In question No.28, put by the Tribunal, Prof. A.K. Gosain, on 14.7.2017, wherein he was informed about the availability of daily discharge data from the hydrological observation maintained at Chapoli and also at several other Sites maintained by the States of

Goa and Maharashtra, for different periods, Prof. Gosain was asked as to why this valuable information, had not been used for the purpose of assessment of

water availability. In answer, Prof. Gosain stated that he had decided not to use the same for his analysis. Prof. Gosain further mentioned that the information in these data observations could be valuable for many purposes, but these data were pertaining to the smaller catchment and many of them were smaller in length, and therefore, were ignored. According to Prof. Gosain, the other reason for ignoring the said data was, on account of the fact that these daily discharge data were not maintained by any independent authority, and therefore, for his study, Ganjim data, which had adequate length and was for a much bigger size of the basin, was taken into

consideration by him.

444.

In view of what is stated by Prof. Gosain, and the information provided by him, in his answer to the questions put to him by the Tribunal, the Tribunal is of the opinion that without any cogent and convincing reasons, Prof. Gosain had excluded the observed discharge data at Chapoli for the purpose of assessment of water availability in respect of (a) Haltara Dam, (b)

Kalasa Dam, (c) Kotni Hydro-Power Dam, (d) Bailnadi Site, and (e) Bhandura Dam Site.

445.

From the testimony of Shri Gosain, it becomes at once evident, that he has not even cared to look into the CWC's selection of Rainfall Stations, and has used the data of the same Rainfall Stations, as used by CWC in its Report, without independently examining as to whether selection of Stations made by CWC was proper and up to the mark. This is, despite being required and expected to do so, as an Expert. In fact, in answer to questions No.126 and 127 asked by the learned Counsel for the State of Goa, Prof. Gosain, has categorically stated that "while preparing my report dated 12.9.2015, my objective was to build on the detailed work done by the CWC, through their Report CWC (2003)", therefore, I did not get into the process of selection of any other non-IMD Rain-gauge Station. Similarly, like CWC, Shri Gosain has without any cogent reason, and without any proper application of mind, accepted the unusually high runoff factors at Ganjim and has not taken

care to re-examine the same, for the reasons best known to him. Prof. Gosain was unable to provide the Tribunal any cogent explanation as to why he had accepted the unusually high runoff

factors at Ganjim and why he has not re-examined the reasons for high runoff factors and had decided to blindly follow what was stated in CWC (2003) Report.

446.

Several deficiencies in respect of filling in missing data were brought to the notice of the Tribunal by the learned Counsel for the State of Goa, during the cross-examination of Prof. A.K. Gosain. The Tribunal had also prepared detailed statements, indicating variations, in the values of Rainfall for the same rain-gauge stations, which were mentioned in the two Reports, i.e. Report of September, 2015, (Volume 166) and Report of May, 2017, (Volume 198). These statements prepared by the Tribunal, are MARK-26 and MARK-27, respectively. When these inconsistencies in the data used, in two different Reports were brought to the notice of Prof. A.K. Gosain, he in his reply to question No.57 put to him on 18.7.2017, inter alia stated as under:

"…The variations between my Report of September 2015 and my May 2017 Report, as depicted in MARK-26, are on

account of additional data, that was earlier missing, becoming available from IMD, as reported in the respective footnotes of the various Annexure Tables. The

other reason of these variations can also be the result of the application of consistency checks…"

447.

Prof. Gosain has not explained as to why the IMD data of previous years were missing and how these data became available at the time of preparation of Report of May 2017. In reply to question No.58 put to Prof. A.K. Gosain on 18.7.2017, inter alia, stated as under:-

"…The variations in the Comparison Table (MARK -27) are on account of the fact that due to some reason the data of this Station is not consistent, as can be made out from the averages provided for various periods as part 'c' of the question. While doing the September 2015 Report, since the decision was taken to use the processed data prior to 2001, for all the Stations as done by CWC (2003) Report, therefore, no reprocessing of this data could have been meaningful. While performing the May 2017 study, reprocessing of the whole rainfall data sets with respect to infilling and

consistency analysis was done. As it can be observed from column 4 of MARK-27, that the data prior to 1981 is appreciably different from the data after 1981, as has been suggested by the averages of the period in the last two rows of column 4 of MARK- 27…"

448.

A bare reading of the above stated reply of Prof. Gosain makes it more than clear that Prof. A.K. Gosain could not explain,

as to what he meant by ‘some reasons’ and the reply given by him, which is reproduced, is indicative of presence of some errors, in the processed data included in the CWC Report of 2003 (Volume 15). Thus the Tribunal finds that the Reports submitted by Prof. A.K. Gosain are deficient in nature and become suspect.

449.

Further the inconsistencies in the data included in CWC Report of 2003 (Volume 15), as well as the data included in September 2015 Report of Prof. Gosain (Volume 166), were brought to the notice of Prof. Gosain and in answer to question No.58, Prof. Gosain stated as under:-

“…It was through thi s analysis that in my study of May 2017, this Station of Castlerock was found to be violating the consistency and correction for consistency was made as per the details given in spread sheet ‘Consistency RF 1964- 12’ of Vol. 199.”

450.

Here also, Prof. A.K. Gosain could not explain as to why the decision was taken by him to use the processed data prior to

2001, for all the Stations as was done by CWC (2003) Report, and why fresh analysis of the data was not undertaken by him. This would indicate that, except placing reliance on CWC (2003) Report, no actual exercise for analysis of the processed data prior

to 2001, of all the Stations was undertaken by Prof. A.K. Gosain. This shows the easy method adopted by Prof. Gosain for preparing his Affidavits and Reports. The Tribunal finds, that the replies/explanations given by Prof. Gosain are far from satisfactory and raise more questions on the procedure, adopted by him, during preparation of his two Reports.

451.

Similarly, the Tribunal finds that Prof. A.K. Gosain, has considered the observed data at Ganjim as correct and consistent, but he himself has chosen to ignore data of 9 years, out of 34 years during the process of development of Rainfall-Runoff Equation. Why the data for the above stated periods were ignored, has not been explained by Prof. Gosain. What is worthwhile noticing, is that the data of about 9 years out of 19 years, were also ignored by the Central Water Commission, while developing the Rainfall-Runoff Equation, and thus, except blindly following the methodology adopted by the Central Water Commission, no further fresh exercise, at all, was undertaken by Prof. Gosain.

999

452.

At this stage, it would be relevant to reproduce question No.27 put to Prof. A.K. Gosain, by the Tribunal on 13.7.2017, and the reply given by him. The same is as under:-

“Q. No.27. We note that you have carried out detailed analysis in respect of homogeneity and consistency of flow data observed at Ganjim and the result of the same have been presented at Para 5.1.1.1, Para 5.1.12 and Para 5.1.2 at pages 26 to 30 of your September 2015 Report. You have also asserted at page 39 that the “observed series at Ganjim has been found consistent”. However, we note that while carrying out the analysis for development of linear regression equation, Central Water Commission ignored the data set of as many as 9 years out of 19 years.

If the data of about 50% of the year, i.e. 9 out of 19 years in case of CWC Study of 2003, are required to be ignored, how can such data be considered as consistent and reliable?

Ans. With due respect, I would like to state that by excluding these 9 years out of 19 years from the process of formulating the R-R equation, does not imply that there is something wrong with the observed flow of these 9 years. They have been ignored by CWC as well as by me as part of the stipulated process, to ensure that there is no unnecessary bias on account of

1000

such extreme events, in the R-R equation, since the equation is required to be used for extrapolation of runoff using the rainfall.

I would like to state that this explanation has been mentioned in CWC (2003) Report as well as my September 2015 Report."

453.

On appreciation of the above reply, the Tribunal is of the firm opinion that the reply given by Prof. Gosain is not at all convincing and the Tribunal is constrained to conclude that the data of Rainfall or Runoff or both have certain element of doubts, and that the Report of CWC 2003, as well as the Report submitted by Prof. Gosain, cannot be, fully, relied upon.

454.

What is important to notice is the fact that Prof. A.K. Gosain, had undertaken, an exercise to rectify the data used by the Central Water Commission in the Report of 2003 (Volume 15), which makes the data used by CWC, also doubtful.

455.

The Tribunal finds that Prof. Gosain, has accepted, without scrutiny, the Rainfall Stations mentioned in the CWC (2003) Report. As noticed earlier, Prof. Gosain had not included the data of Gavali and Chapoli Stations in his study of September

2015 (Volume 166). However, subsequently Prof. Gosain had used, the data of Gavali and Chapoli Stations, in his study of November, 2016 (Volume 193). Therefore, question No.149 was put by the learned cross-examiner, on behalf of the State of Goa, to Prof. Gosain as to why he did not use the data of Gavali and Chapoli Stations in his September 2015 study. The Tribunal notices that Prof. Gosain refused to answer the said question by maintaining that it was “consciously decided to consider only 15 IMD Stations”. Prof. Gosain, with great respect to him, failed to give a substantial reason for such important noticeable discrepancy. In the absence of any such explanation, the Tribunal is also unable to understand and perceive the reasons as to why data of Gawali and Chapoli Stations were not included in the September 2015 study of Prof. Gosain, and he left it to fend for itself. This compels the Tribunal to cast aspersions on the reliability of the Study made by Prof. Gosain.

456.

A major contradiction comes to the notice of the Tribunal, that Prof. Gosain, in his subsequent Study as mentioned

in Affidavit-in-Evidence dated 11 th May, 2017, indicates the use of entirely different rainfall data, as compared to CWC (2003) Report (Volume 15) in his study as mentioned in Affidavit-in-

Evidence dated 12 th September, 2015. In relation to this contradiction, question No.285 was put on behalf of the State of Goa to Prof. Gosain, and he answered the same by stating that to explain the difference found in his 2015 Study, and his Study conducted in May, 2017, he had not undertaken the processing of rainfall data himself and that he had used the processed data from CWC (2003) Report, whereas in his 2017 Study, he had done the data processing himself. What is important to notice is, that Prof. Gosain by giving the above mentioned explanation, has made CWC (2003) Report highly suspect. Moreover, it will be for Prof. Gosain to demonstrate as to how the study conducted by him in 2015 stands, despite the differences which were brought out by himself in his May, 2017 Study, which makes both the Reports unreliable. What is found by the Tribunal is that Prof. Gosain, has been unable to clearly and categorically explain the reasons for inclusion and exclusion of the discharge data, used by CWC, in his Studies of September 2015 and May, 2017. What is noticed by the Tribunal, is that by using different raw data sets, Prof. Gosain has virtually contradicted his own two Reports.

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457.

At this stage, it would be relevant to notice Issue No.35, which is as under:-

“Issue No.35. Whether the State of Karnataka proves that the total availability of water from the Mahadayi river basin within the State of Karnataka is 44.15 tmc (1250.19 Mcum) at 75% dependability and 52.60 (1489.52 Mcum) at 50% dependability.”

458.

The water available from the Mahadayi River Basin within the State of Karnataka, i.e. from the catchment area of 375 sq.km., has been estimated by Prof. A.K. Gosain, expert witness of the State of Karnataka. He has estimated the annual gross yield at Goa/Karnataka border based on catchment area proportion with respect to Ganjim for the years 1979-80 to 2012-13. From Table 11 at page 9 of Volume 166, the Tribunal notices that the total water available from the catchment area of Mahadayi basin, including its tributaries, within the State of Karnataka, as per the assessment made by Prof. A.K. Gosain, is

43.57 tmc (1234 Mcum) at 75% dependability, and 52.37 tmc at 50% dependability. Prof. Gosain has also estimated, the total water available, from the catchment area of Mahadayi basin, including its tributaries within the State of Karnataka, in his Report of May 2017 (Volume 198). From Table 4, which is at page

10 of Volume 198, the Tribunal finds that the annual gross yield at Goa/Karnataka Border based on catchment area proportion, has been assessed by Prof. A.K. Gosain as 43.20 tmc (1223 Mcum) at 75% dependability and 51.7 tmc (1460 Mcum) at 50% dependability. However, the Tribunal notices that in both the cases, the value of the water availability from the catchment area of Mahadayi basin, including its tributaries, within the State of Karnataka, has been estimated on the basis of the catchment area proportion. The Tribunal further finds that Prof. Gosain has adopted a different approach of assessment of yield of various Project Sites, by using the catchment area proportion as well as the rainfall proportion, and while assessing the overall availability of water from the catchment area of Mahadayi basin in Karnataka, Prof. Gosain has not taken into consideration the variation in the rainfall. This is yet another drawback found by the Tribunal in the Report of May 2017 (Volume 198) submitted by Prof. A.K. Gosain before the Tribunal.

459.

Moreover, in this regard, the Tribunal notices that the

assessment of water availability from the catchment area of Mahadyi basin, including its tributaries, within the State of Karnataka, is based on the observed Runoff at Ganjim, and

therefore, the correctness and acceptability of the values of water availability in the catchment area of Mahadayi basin, including its tributaries, within the State of Karnataka, is subject to acceptability of the Runoff Series at Ganjim and the Rainfall-Runoff Equation developed for catchment up to Ganjim.

460.

The Tribunal finds that Prof. A.K. Gosain's Study of September, 2015, actually is not a self-contained or independent yield study at all. Prof. Gosain has accepted from CWC study, the Rainfall Stations as selected by CWC. The Thiessen polygon and the Thiessen weights, as well as processed Rainfall data up to year 2000, and computation of non-monsoon contribution, have been taken by Prof. Gosain, while preparing his Study of September, 2015. Thus, the same data was adopted without its critical examination. All that Prof. Gosain has done is that he has added Rainfall and Runoff data for 12 more years, from 2001 to 2012, and has reworked the arithmetic. However, as stated in his report, for derivation of Regression Equation, he has rejected the data for the years, where the runoff factor is more than 1.0, as

against 0.9 by CWC. This study is not capable to stand on its own and cannot be described as an independent Study of Prof. Gosain. In fact, the Tribunal finds that basically a few cosmetic

changes have been made in CWC (2003) Study, to pass it off as that of Prof. A.K. Gosain's Study. Prof. Gosain has borrowed from CWC study, almost all the data, without caring to find out as to whether what he was adopting, was correct or not. Therefore, obviously mistakes, such as 2874 mm repeating 14 times in the data of Mapuca, or the errors in determination of non-monsoon contribution, has escaped the notice of Prof. Gosain, or he has ignored the same, because he had to produce the result that 'agrees' with the CWC.

461.

The most objectionable part of the Study of Prof. A.K. Gosain is the manner, in which he has handled the data of Castlerock Station. It has been pointed out to the Tribunal by the State of Goa, that the data of Rainfall Station of Castlerock, for the period up to 2000, is suspect and seems to be very much on the lower side. The Tribunal finds that the data for all the years up to 2000, is consistently low, and therefore, consistency checks applied by the CWC to the data up to 2000 only could not have detected anything being amiss. Prof. Gosain has extended this

data from 2001 to 2012 and the Tribunal finds that there is a marked discontinuity in the data of Castlerock for the years 2000-2001, and data from 2001 to 2012. This discontinuity in the data

ought to have been detected by Prof. Gosain, and in fact, he did detect the same, and on finding that the data is inconsistent, and that it will have to be rejected, he has taken care to see that it is not properly projected before the Tribunal. The Tribunal notices that the witness has drawn, the double mass curve only up to the year 2000, and thereby has not allowed the inconsistency to surface. Another objectionable part of the Study of Prof. Gosain is, his method of handling of the outliers, that is, years to be excluded, when deriving the Regression Equation. The Tribunal notices that CWC has excluded the years with runoff factors, exceeding 0.9, but, Prof. Gosain, after repeatedly emphasizing that the CWC's procedures are standard, and after asserting that he has followed the same, he has only added some more years data, and has quietly taken into consideration the data of the years with runoff factors up to 1.0. The Tribunal finds that Prof. Gosain has taken into consideration that part of CWC (2003) Report which was convenient to him, and which suits the purposes of the State of Karnataka.

462.

According to Prof. Gosain he had derived the Regression Equation by excluding the data for years, where the runoff factor exceeded 1.0. This derivation of the Regression

Equation is estimated by Prof. Gosain at least on three occasions. In para 7.4.2 at page 43 of his Report, Prof. Gosain states that "The years which showed runoff factor of more than 1.0 have been excluded". In reply to question No.179, he has r eiterated this by stating "Therefore, in this procedure, as per the practice, only runoff factors, which are more than 1.0, are ignored, and is presumed, that the other factor will compensate each other". From the later part of the above quoted sentence, it becomes very clear that it was his considered decision to retain the data for the years where the runoff factors were less than 1.0 and he expected that these factors, which were less than 1.0, to compensate some other years. The Tribunal finds that to remove any further doubts, he had reiterated this yet again, in his reply to question No.187, where he had stated "As far as my above referred equation is concerned, it has been derived by ignoring all the years with the runoff factor more than 1.0".

463.

The Tribunal finds that derivation of Regression Equation is a statistical procedure without involving principles of

hydrology. For the purpose of water availability assessment, the preparation of time series of runoff and the weighted rainfall over the catchment to be used for development of rainfall-runoff

relation is the major task. After that it is statistical analysis, and any person taking the runoff and the concurrent weighted rainfall data from Prof. A.K. Gosain's 2015 Study, and excluding the da ta for the years with runoff factor more than 1.0, can obtain, the same Regression Equation, as obtained by Prof. Gosain. The Tribunal notices that the State of Goa tried this and got a different Equation.

464.

This aspect of the matter was put to Prof. Gosain in question No.187, and he was requested to demonstrate as to how he had got the Regression Equation:

Runoff =

0.7368*Rainfall + 432.28. The Tribunal notices that the witness totally failed to demonstrate as to how he had got the Regression Equation mentioned above. Instead of giving a straight answer, he stated that after one does not use the proper information, while deriving the R-R Relation, one is bound to get different equation. In answer to question No.193 put by the Tribunal to Prof. Gosain, he stated as under:-

“On being asked to demonstrate the working of the regression equation in my Report of September, 2015, I explored the computation during the lunch time, and found that while making the computations for arriving at

R-R relationship, the data of one year namely 1979-80, inadvertently got missed. Therefore, the R-R relationship that was obtained and presented in my Report of September, 2015, is different from the one which would emerge by adding the data of years 1979-80. The equation with this year incorporated would become:-

RO = 0.731 *P + 450.77."

465.

As a part of this reply, he also handed over a computation, titled "RR - 2012_Given", which contained his data and arithmetic used by him. Prof. Gosain has commented, on the question of RO = 0.731 *P + 450.77 and stated that "Although the equation looks different in terms of its value, but it will have a very fractional difference in the final yield, which has been obtained in my September, 2015 Report." The Tribunal notices that at that point of time, Prof. Gosain had not taken the computations to the end using his new regression equation but obtained the aimed results, by using his new Regression Equation, and therefore, the Tribunal finds that, his statement,

that it will have a very fractional different on the final yield, is just a fond hope on his part.

466.

The Tribunal finds that what will be the yield with the equation: RO = 0.731 *P + 450.77, is immaterial, because that

equation is incorrect. Prof. Gosain, with the equation using data from “RR - 2012_Given” and following his logic, the State of Goa tried to verify the new equation offered by him and the said equation could not be obtained by the State of Goa, because there were, obviously, more errors. The Tribunal further notices that Prof. Gosain has excluded the data for the year 2006, despite the Runoff factor for the said year is less than 1.0 and he has changed the Runoff for the year 1998 from 3258 mm to 3219 mm, without assigning any cogent reasons.

467.

All this was put to Prof. Gosain in question No.207 when he was asked to explain as to why the data for the year 2006 was excluded, and why the Runoff for the year 1998 was arbitrarily changed by him, and why all these facts were not brought to the notice of the Tribunal, while replying to earlier questions, which were put to him, in relation to derivation of Regression Equation.

468.

The Tribunal notices that Prof. Gosain admitted that

he had excluded the data for the year 2006, and that he had changed the Runoff data of the year 1998. He stated that “As far as the value of gross yield of the year 1998, being put as 3219

mm, against 3258 mm, at this juncture, it appears to me as a typographical error.” The Tribunal is of the firm opinion that this explanation of Prof. Gosain is not convincing at all and has been mentioned as an after-thought. The reason is that one, who knows how Excel spreadsheet is used, knows that once data is entered and checked, it is copied as columns and rows. On first page of “RR_Given”, there a re three Tables, and the right-most Table, where the data is incorrect and the right-most table, where data is found to be incorrect, by the Tribunal, is obtained, simply by making a copy of the Table in the middle and by deleting from it, the data from the certain cells. The Tribunal finds that there is no way, that such an exercise can result in a typographical error, in one cell. According to the Tribunal, this is not a typographical error or otherwise but the Tribunal is of the view that the plain simple fact is the equation RO = 0.731 *P + 450.77 remains incorrect. Prima facie, the Tribunal is of the opinion that the equation, which is at least correct in arithmetic, can be obtained, only when the data for the year 2006 is included in the Study, and the Runoff for the year 1998 is corrected.

Further, the Tribunal finds that the two wrong equations offered by Prof. Gosain, have a large positive intercept, which, in general,

is not acceptable in rainfall-runoff equation derived for monsoon season.

469.

To summarize, the study of Prof. A.K. Gosain in September, 2015, is not found to be an independent study, by the Tribunal. The Tribunal finds that Prof. Gosain has merely reworked the arithmetic of CWC Study, with 12 more years of data. The Tribunal further finds that since Prof. Gosain has used the processed Rainfall data from the CWC Study, his study includes all the errors which are found in the CWC Rainfall data processing. The Tribunal notices that reliance placed by Prof. Gosain on his consistency che cks, for acceptance of CWC's processed data, is not only misplaced, but has no merit whatsoever, because he has checked for consistency data, that had already been checked, and had been modified to make it consistent. The Tribunal finds that glaring anomalies, like the value of 2874 mm, appearing 14 times in Mapuca data, was completely ignored by Prof. Gosain. The Tribunal also notices that

in Castlerock data, there is material inconsistency for the year 2000-2001, and therefore, Prof. Gosain drew the double mass curve for Castlerock, only for the years 1964 to 2000, so that the inconsistency does not surface or is apparently reflected. The

1014

Regression Equation obtained by Prof. Gosain is found to be incorrect, even in arithmetic. Though he was offered the opportunity, Prof. Gosain failed to replace the earlier wrong equation. For all these reasons, the Tribunal is of the opinion that, his assessment of the yield, mentioned in his Report of September 2015 cannot be accepted and is hereby rejected.

470.

As mentioned earlier, Prof. A.K. Gosain, without obtaining any permission from the Tribunal, produced a fresh Study in May 2017, (Volume 198), to give “credence” to his Study of September, 2015, before the Tribunal. It is his case that he had carried out fresh Study in May 2017 (Volume 198) to give credence to his September, 2015 Study. One would need to lend credence, when one finds, that the earlier report of September 2015 was defective and or erroneous. The Tribunal notices that during the cross-examination, no necessity arose for Prof. Gosain to lend credence to his own report of September 2015. The Tribunal finds that production of Study Report of May, 2017 is highly improper. This fresh Study is also not able to stand alone,

and thus lacks as an independent study. A scrutiny of May, 2017 Study makes it very clear that it is a re-production of CWC (2003) Study, with the same selection of Stations, the same Thiessen

weights, etc. A thing, which is noticed by the Tribunal, is that in May 2017 Study, made by Prof. Gosain, he himself has done the processing of Rainfall data. The Tribunal further notices that he has used the Rainfall data from a different source, and therefore, the processed Rainfall data calculated by Prof. Gosain, is different from the one, used by him, in September 2015 Study. The Tribunal further finds that May, 2017 Report of Prof. Gosain, has resulted in a strange situation, where Prof. Gosain offers two different data values for the rainfall of the same Station, and for the same year. For example, the Tribunal notices that, as far as Castlerock Station is concerned, Prof. Gosain, in his September 2015 Report has stated that at the above said station the rainfall was 1772 mm in the year 1964, but in his May, 2017 Report, Prof. Gosain has stated that it was 6920 mm. This is just an illustration, referred to by the Tribunal. The Tribunal is of the opinion that Prof. Gosain, as the author of his Report of May, 2017, is not sure about the rainfall at Castlerock, and therefore, neither of his reports can be accepted.

471.

The Tribunal further finds that the unprocessed IMD data was available, and in answer to question No.98, Prof. Gosain has stated that if the unprocessed IMD data was made available

to him, he can do reprocessing himself and produce the result in the next hearing.

Why the unprocessed IMD data, which was available, was not used by Prof. Gosain, has not been explained by him. The Tribunal finds that if Prof. Gosain had used the authenticated IMD data taken from CWC (2003) Report, and had processed it correctly, then the processed data would have been different from one mentioned in CWC (2003) Report. If such an exercise had been undertaken by Prof. Gosain, the results would have not only contradicted his evidence mentioned in 2015 Report and 2017 Study, but also would have demonstrated that the results mentioned in CWC were also wrong. The decision taken by Prof. Gosain to agree with CWC Report of 2003, at any cost, merely because of the stand taken by the State of Karnataka, has vitiated his two Reports.

472.

In view of the inconsistencies, drawbacks, limitations and deficiencies, which are noticed by the Tribunal, not only in the testimony of Prof. A.K. Gosain, but also in his two Reports,

the Tribunal is of the firm view that his Studies cannot be taken into consideration, for estimating the yield of Mahadayi Basin.

1017

Evaluation of Oral Evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka

473.

Shri A.K. Bajaj, RW2, has deposed before the Tribunal with respect to topic ‘Hydrology - Water Balance Analysis’. From his testimony it becomes evident that he was the Chairman of C.W.C. from April 2008 till 31st October 2011 and during his tenure in CWC, he had worked on and examined many Inter State Water projects. Shri Bajaj has stated in his Affidavit-in-Evidence dated 30th December 2016 that he was requested, by the Water Resources Development Organisation of the State of Karnataka to carry out, a Hydrological Analysis of diversion by the upstream States in Mahadayi Basin which would also include a water balance analysis in the context of trans-basin diversions of the Mahadayi waters to the Malaprabha Reservoir and Kali Reservoir as planned by the State of Karnataka. He has stated that, he has carried out the analysis and is therefore, he is deposing, before the Tribunal.

474.

Shri A.K. Bajaj (RW2) filed his Affidavit-in- Evidence dated 30th December 2016. From the said affidavit it is evident that he had conducted a study t itled as “Hydrological Analysis of

the Diversions and Utilisations by the Upstream States in Mahadayi Basin" which is annexed as 'Annexure A' to his affidavit. In his study, the Tribunal finds that, he has come to the following conclusions:

(a)

There is a large quantity of water in Mahadayi Basin as estimated at around 200 tmc, by both the CWC and Professor A.K. Gosain of IIT Delhi. Out of this water, the present utilisations of Goa are only 9.395 tmc and the planned utilisations are only 38.53 tmc, inclusive of the present utilisations. For coming to this conclusion, Shri Bajaj has relied upon reply of Goa to interrogatories administered by State of Maharashtra and State of Karnataka which are at Volumes 102 and 103 respectively.

(b)

Even after cons idering Maharashtra's proposed diversion of 180 Mcum (6.35 tmc), the diversions and

utilisations claimed by Karnataka are not incompatible with the planned utilisations by Goa, and in particular the 10 projects in Goa, namely, Sonal I, Surla I, Surla II, Derode I, Mandovi Nanoda, Surla III, Kharmol,

Mayada, Khadki weir and Ganjim weir, which are in the shared catchment for utilisation of 10.59 tmc, are not likely to suffer hydrologically.

(c)

As against the originally estimated inflows which were the basis for the planning of both Malaprabha Reservoir and Supa Reservoir across Kali river, they have suffered acute shortage of inflows into these reservoirs and therefore, diversion of water from Mahadayi, which is in surplus, becomes necessary in the larger interests of the inhabitants of the State of Karnataka.

(d)

The non-utilisation by Karnataka or Maharashtra, as planned, would only result in surplus going to sea.

(e)

The maintenance of natural equilibrium of Mahadayi River in Goa would be wholly inconsistent with the principles of water utilisation and management of the

Mahadayi basin.

1020

475.

Along with his affidavit dated 30 th December 2016, Shri Bajaj has also relied upon, inter alia, the following documents:-

(a)

Hydrological Analysis of Diversions and Utilization by the Upstream States in Mahadayi Basin prepared by him which is marked as EXH. KAR-RW2/1;

(b)

A Map titled as “Projects in Mahadayi basin with shared catchment between the States of Karnataka and Goa” prepared by the office of the Chief Engineer (ISW), Water Resources Development Organization, Bangalore which is marked as MARK-KAR/10.

476.

The Tribunal has minutely perused the affidavit in evidence filed by the witness, his cross-examination made by the learned Counsel for the State of Goa and answers given to certain questions which were put to the witness, by the Tribunal, to

elicit better information from him. On such perusal, the Tribunal finds many inconsistencies in the evidence of Shri Bajaj which are enumerated herein below:-

1021

(a)

Firstly it is important to note that the witness, Shri Bajaj himself has admitted that he is not an expert in hydrology. He has stated that he does not have a degree in Hydrology, let alone received any formal education on the subject of hydrology. In response to question No.10, asked on behalf of the State of Goa, Shri Bajaj has categorically stated that “I am not an expert on the specific subject of Hydrology”.

(b)

Though Shri Bajaj, despite having prepared the water balance study, has not undertaken any site visits i.e. rain gauge Stations etc. in the shared catchment area, as admitted by him in response to QT. Nos. 4 and 5.

(c)

In answer to question No.44 which was asked by the State of Goa, Shri Bajaj has stated that he had merely accepted the findings of Prof. Gosain and Shri Huddar as they have followed the standard procedure of

processing the rainfall data, applying consistency checks and thereafter doing regression analysis to work out the yield without applying any other extraneous factor or using the observed data

selectively. From his answer to question No. 44, the Tribunal finds that, Shri Bajaj has not exercised his own judgment and checked the various parameters but has accepted the findings of Prof. A.K. Gosain and Shri Huddar as gospel truth. Shri Bajaj has merely checked the various parameters on the basis of data provided by Prof. Gosain and Shri Huddar and has failed to make his own conclusions on the data of the earlier studies. Further, Prof. Gosain and witness Shri Huddar, have excluded some of the data from consideration and witness Shri Bajaj has failed to satisfy the Tribunal as to why those data were excluded.

(d)

When the State of Goa confronted Shri Bajaj, with all the discrepancies in CWC (2003) Report as well as in Shri Gosain's Report, it becomes at once, evident that, Shri Bajaj was not even aware of the details contained

in the Report, even though he has heavily relied upon both the Reports. This position becomes clear from answers given by Shri Bajaj to question Nos. 31 to 33, 41, 76, 77, 80, 92-93, 105, 106 and 107.

1023

(e)

Further, a reading of the response to question No. 95 asked by the State of Goa to the witness, makes it more than clear that Shri Bajaj has admitted that based on his Report, it is not possible to prove that the Malaprabha Basin is a deficient basin. The Tribunal finds that, his study was limited to the basin area upto Malaprabha Dam, and not of the Malaprabha Basin as a whole. Therefore, the Tribunal is of the opinion that the State of Karnataka, has been unable to prove through the evidence of Shri A.K. Bajaj that the Malaprabha Basin is deficient.

(f)

The Tribunal finds that when Shri Bajaj was confronted with the errors and flaws in the computation of the yield of the Malaprabha River and also the planning and formulation of the Detailed

Project Reports for Malaprabha Reservoir, he was unable to provide the Tribunal with any reasonable justification.

Instead of giving any reasonable justification, the errors and flaws pointed out to him were merely denied by him, without assigning reasons.

(g)

In response to question No. 84 (b), Shri Bajaj was confronted with the large scale sugarcane cultivation undertaken in the State of Karnataka. Shri Bajaj has admitted that sugarcane crop pattern were not even considered in his Report submitted before the Tribunal. Thus the Tribunal finds that when such integral topics are not taken into account, then the entire study does not project a clear picture and looks tailor-made to suit the needs of the State of Karnataka.

(h)

In response to question No. 108, Shri Bajaj was confronted by the State of Goa with the proposal to utilize the waters of Bennehalla Nalla which was prepared by Shri Sudheer Sajjan who is/was an engineer with the Water Resources Department of Government of Karnataka. The proposal is marked as Annexure-D to the additional affidavit of Examination-

in-Chief of Shri Chetan Pandit and is to be found at Page 146 of Vol.192. In this proposal Mr. Sajjan has estimated the yield of Bennehalla Nalla as 10.92 tmc at 75% dependability, of which, as per the said

proposal, hardly 1.5 TMC has been put to use. The Tribunal finds that Shri Bajaj acknowledged the same but despite having been given ample opportunity, he refused to sufficiently justify as to why, the waters of Bennehalla Nalla was not considered by the State of Karnataka as an available water resource.

(i)

The Tribunal also finds that throughout his study, Shri Bajaj has, at no point of time, taken into account any environmental flows whatsoever, which should have been actually integral part of his study.

(j)

Further, in response to questions No. 58 and 61, Shri Bajaj admits to the casual approach of the State of Karnataka, in respect of environmental needs and concerns and mandatory licenses and clearances, despite the fact that every State is required to obtain clearances etc. under the law. In fact, in response to question No.58, Shri Bajaj has categorically stated that

no State can take up any water resources project, unilaterally on any inter-State rivers, without proper clearances from the Central Government on all

aspects including clearance of the inter-State matters. This statement goes against the very basis of the case put forth by the State of Karnataka.

(k)

The Tribunal also finds that Shri Bajaj could not provide to the Tribunal, explanation of any kind, when the Tribunal asked him question No.3 about the reason for his suggestion that if the surplus water is not transferred, it will flow unutilized into the sea. Therefore, in the absence of any reasoning to support the same, the Tribunal finds no merit in this suggestion of Shri Bajaj.

477.

The answer given by the witness to question No. 36 of the Tribunal, was that the existing water uses for irrigation etc. had to be protected while framing revised DPR, and it was not possible to divert water from there for the drinking water requirements. The witness further stated that he was not in a position to say why only 0.201 tmc had been provided for

drinking water, as this decision was taken by the Project Engineer, while framing the revised DPR.

478.

The casual and indifferent approach adopted by the witness Shri Bajaj becomes evident if one peruses the question Nos. 32, 33 and 34 put to the witness by the learned Counsel for the State of Goa and answers given by him to those questions. The question Nos.32, 33 and 34 and answers thereto are re-produced for ready reference, which are as under:

“Q.No.32. The question asked to you at serial No. 31 was as regards the runoff at Ganjim exceeding the monsoon rainfall for 4 out of the 5 years, and whether this phenomenon is acceptable to you. The question was not regarding your agreeing with Prof. Gosain or not. Will you please answer the question appropriately, as posed to you?

Ans. Yes, the phenomenon of runoff exceeding the rainfall is acceptable to me.

Q.No.33. What are your reasons for accepting this phenomenon or for agreeing with Prof. A.K. Gosain in this regard? Can you produce authentic literature with

scientific basis about the acceptance of such a phenomenon?

Ans. While working as Chairman, CWC, I have had to rely on the Reports and facts and figures put up before me by the relevant experts in the field. I did not have to personally cross check the material placed in these Reports. That is why, in this case also, Prof. Gosain being the expert in Hydrology, I have accepted his Report. Even

I, after working for nearly 4 decades in the Water Resources Field, cannot claim to be an expert on everything. However, the requested authentic literature with scientific basis can be produced by me during the next date of hearing.

Q.No.34. Your answer to the preceding question only shows that, as the CWC Chairman, you were accepting whatever was put up to you, without verifying or cross-checking the same. That may be so, when you were the Chairman, CWC. Today the questions are being asked to you by virtue of your being cited as an Expert Witness in the field of Hydrology by the State of Karnataka and for this reason you have been administered the oath also. I again ask you to answer the questions posed to you in the two earlier questions namely question Nos. 31 and 32 as regards the reasons for accepting this phenomenon. When the runoff is more than the rainfall, it is obvious that there has to be some extra source of water. Please explain, what are those extra sources of water for these

particular years, as posed in question No.31, over and above the rainfall?

Ans. Hydrology and hydrological flows are a complex phenomenon. There is a continuous infiltration and regeneration from the ground water below the river bed. This also changes from season to season and the phenomenon of sometimes the runoff being more than the rainfall can occur."

479.

The above stated answers make it clear that as Chairman of CWC, he had relied on the reports and facts and

figures put up, before him by the relevant experts in the field and that he himself had never taken the trouble to personally cross-check the material/analysis/particulars/statements made, in those reports, to verify, whether the facts were correctly mentioned or whether the analysis made in those reports were based on well established principles of hydrology or not etc. He has not mentioned, as to why and for what reasons, he had decided to accept the report of Prof. Gosain. The witness had never noticed that the runoff was more than the rainfall. Thus Annexure-A to his affidavit dated 30.12.2016, which is a hydrological analysis of the diversion and utilization by the upstream States in Malaprabha Basin, can hardly be relied upon by the Tribunal.

480.

In the light of the above discussion, the Tribunal is of the opinion that the evidence tendered by Shri Bajaj, on behalf of the State of Karnataka cannot be relied upon, since it is wholly inconsistent with the case put forth by the State of Karnataka. In

fact, the Tribunal observes that the answers given by Shri Bajaj in his cross-examination, disprove to some extent, the case put forth by the State of Karnataka. The study undertaken by Shri Bajaj is deficient and incomplete. The study of Shri Bajaj, thus

1030

suffers from several draw-backs and limitations. The statements made by the witness in his affidavit and answers given by the witness during the course of his cross-examination, make his testimony unworthy of acceptance. Under the circumstances, the Tribunal is of the view that it would not be safe to place any reliance on his testimony relating to subjects, on which he has deposed.

Evaluation of Oral Evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra

481.

Shri S.N. Huddar, MW1, witness for the State of Maharashtra, has deposed before the Tribunal, with respect to the topic, ‘Hydrology and Availability of Water’. From the data furnished by Shri Huddar, in his Affidavit, it becomes evident that, he had occupied the post of Secretary (CAD), Water Resources Department, Government of Maharashtra, Mumbai and then, had retired in 2006. The data also indicates that he had also worked as an Assistant Director in the Central Water Commission from 1975 to 1976. His data would show that, he

was also appointed by the Government of Maharashtra as an Advisor, on the matters related to the Krishna Water Disputes and for obtaining clearances to the various irrigation projects of

Maharashtra. As stated in his Affidavit, in August, 2015, he was requested by the Government of Maharashtra, to study, water availability in the Mandovi Basin and depose before the Tribunal, with regard to the

State of Maharashtra's case for water

availability, in the Mandovi basin as well as the State of Maharashtra's contribut ion in the Mandovi basin. From the averments made in his Affidavit, it is evident that Shri Huddar is also currently working as an Advisor, to the Government of Maharashtra, in the matter of, the Inter-State Water Disputes, with regard to the Mahadayi River.

482.

Shri S.N. Huddar has filed his Affidavit-in-Evidence,

before the Tribunal on 13.09.2015, on the topic of "Hydrology and Availability of Water". Shri Huddar has also conducted a study on availability of water in the basin and has come to the following conclusion:-

"…I consider 5913 Mcum as the water availability in

entire Mandovi basin including import component as

water availability plus return flows to be evaluated, as the water availability from Mandovi basin for allocation purpose”.

1032

483.

The witness has stated that the allocation of water of Mahadayi River Basin should be decided at 75% dependability. The Tribunal finds that Shri Huddar has added the import of water, from the Tillari Basin, in his calculations, of water availability, for which he has relied upon, the Krishna Water Disputes Tribunal's decision. However, the Tribunal finds that in the present case, there is already an agreement between the State of Goa and the State of Maharashtra, with regard to the Tillari Basin.

484.

Along with his Affidavit dated 13.09.2015, Shri Huddar has relied upon the following documents:-

(a)

Annexure 1 to the Affidavit:- "Note on study about yield of Mahadayi basin out of Central Water Commission in March 2003" prepared by Shri Huddar.

(b)

Annexure 2 to the Affidavit:- An agreement between

the State of Maharashtra and State of Goa for execution and management of Tillari Irrigation Project dated 06.04.1990.

1033

(c)

Annexure 3 to the Affidavit:-

Central

Water

Commission,

Government of India,

Project

Appraisal

Organization dated 19th December, 2009 dealing with

the subject of 101 st meeting of the Technical Advisory

Committee (TAC) held on 30.11.2009.

(d)

Annexure 4 to the Affidavit:-

Tillari

Inter-State

Irrigation Project, dated 12.09.2015 dealing with

Water Assessment of Goa State in Tillari (Chapora)

and Mahadayi basin (colly.).

(e)

Annexure 5 to the Affidavit:-

Assessment of Water

Availability in Maharashtra Catchment Area in

Mandovi Basin.

485.

Shri Huddar was cross-examined on behalf of the

State of Goa, by Shri Dattaprasad Lawande, learned Advocate

General of the State of Goa, with regard to his Affidavit-in-

Evidence and the documents produced by him.

486.

The Tribunal has perused the Affidavit-in-Evidence

dated 13.09.2015 of Shri Huddar, along with his cross-

examination. The Tribunal finds that, there are some parts of his own study, which he has not been able to substantiate and explain. Further, certain other inconsistencies, which are reflected in the study, conducted by Shri Huddar, are noticed by the Tribunal. They are as under:-

(a)

A reading of the responses of Shri Huddar to question nos. 1, 3, 4, 5 and 10 asked to him, by the learned Counsel for the State of Goa, shows that Shri Huddar has merely carried out a checking of the R-R equation of CWC. The Tribunal notices that, in fact, in response to question No. 4, Shri Huddar has admitted that he has not fully scrutinized all the parameters of the CWC Report and had only looked at the rainfall-runoff equation. Thus, it is apparent that, he has merely taken into consideration, only the CWC Report and has estimated yield to be 5652 Mcum at 75% dependability. In response to question No. 18, Shri Huddar has admitted that, besides checking out R-R

equation of CWC, he had not checked any other computations provided in the CWC Report. The response given by Shri Huddar, leads the Tribunal to

come to the conclusion that Shri Huddar, has not conducted any independent study, but has only checked the aspects of rainfall runoff equation of the CWC Report. It is clear from his testimony that he has accepted all the parameters as adapted by CWC and has followed them blindly, without performing any sort of checking whatsoever.

(b)

The Tribunal further finds that in answer to question No. 13, Shri Huddar has stated that the gauge data, which was supplied to him, was subjected to various checks by the Chief Engineer, Hydrology Project, Nasik and, therefore, he has not checked this data himself. In his response, to question No. 5, asked by the Tribunal, he has admitted, to not having checked the consistency data of Ganjim site of CWC using the Virdi gauging station data. This is important when witness Shri Huddar has admitted to not having checked the data particularly with reference to Virdi data for the

purpose of external consistency checks and merely having taken the data, which was provided in the CWC Report. It is for these reasons, inter alia, that the

Tribunal finds that Shri Huddar has not conducted a study in its true sense, on the availability of water, in the Mahadayi River Basin.

(c)

The various discrepancies in the CWC Report were brought to the notice of Shri Huddar, when he was put questions No. 20 & 21, during his cross-examination, by the learned Counsel for the State of Goa. The Tribunal notices that Shri Huddar has, in fact, admitted to all these discrepancies and the only explanation offered by him is that the discrepancies mentioned in questions Nos. 20 & 21, are not serious enough to affect the yield figure worked out by him. The Tribunal is of the opinion that the answer given by Shri Huddar is not convincing at all. The Tribunal finds that Shri Huddar was aware of these discrepancies and, therefore, he should have either rectified the same or should have clearly shown that these discrepancies are not serious enough to affect the

yield figure. What the Tribunal finds is that, no reasons have been given by Shri Huddar as to why the

discrepancies pointed out to him are not serious enough to affect the yield figure worked out by him.

(d)

A bare reading of answers given by Shri Huddar to questions No. 9, 24 and 26, put by the learned Senior Counsel for the State of Goa, shows that Shri Huddar has contradicted his own statement made about the smaller catchment having a larger run-off, when he was asked to explain the same in light of discharge data of Virdi and Ganjim. The Tribunal notices that Shri Huddar was unable to, fully explain the same in detail, which in turn leads the Tribunal to record a conclusion that Shri Huddar has not assessed and performed any checks, on the Ganjim data.

(e)

The Tribunal finds that Shri Huddar has excluded data of some years while computing the yield. With reference to the said exclusion, question No. 28 was put to him by the learned Advocate General of the

State of Goa. In response, the witness has stated that, the data of 9 years was excluded since it was not within the acceptable range of runoff, which according

to him, was 0.65 to 0.9. The Tribunal notices that, except making a bald statement, no reasons are provided by the witness to the Tribunal, as to why the data of 9 years was found to be not within the acceptable range of runoff. The Tribunal further notices that when the witness was asked question No. 30, by the State of Goa, as to why he had included data of 10 years, even though that too was not within the acceptable range, the witness gave a very vague answer by stating that the same was also done by CWC. Under the circumstances, the Tribunal is left with no option, but to record a finding of fact that the entire study, conducted by Shri Huddar is merely in the line with the CWC Report, since, all the parameters mentioned in the CWC Report, are merely accepted by the witness, without scrutiny of any kind.

(f)

The Tribunal further notices that in response to question No. 10, Shri Huddar has admitted that he

arrived at the figure of 5913 Mcum, by adding 261 Mcum, which is the import of the Tillari Irrigation Project, to the figure of 5652 Mcum, which is the

water availability worked out at 75% dependability, assessed by CWC. The Tribunal also notices that in response to question No. 14, Shri Huddar admitted that the study was not for the quantum of utilizable water. The Tribunal is of the view that once the quantum of utilizable water is excluded from consideration by Shri Huddar, the whole purpose for which Shri Huddar was engaged to undertake a study stands defeated.

487.

In the light of all above, the Tribunal finds that Shri Huddar has not conducted any independent study, but, has merely conducted a checking of the CWC Report without even scrutinizing it completely. As admitted by Shri Huddar, the Tribunal finds that the figure of 5913 Mcum is arrived at by Shri Huddar, by adding 261 Mcum, which is the import of Tillari Irrigation Project, to the figure of 5652 Mcum, which is the water availability at 75% dependability, as assessed by CWC. Therefore, the Tribunal finds that the evidence tendered by Shri Huddar, on

behalf of the State of Maharashtra, cannot be relied upon.

1040

Evaluation of Oral Evidence of AW-2 Shri Paresh Porob for the State of Goa

488.

Mr. Paresh Porob has deposed on behalf of the State of Goa, especially on the Wildlife and Forest, which can and likely to be affected within the region of flow of river Mahadayi and its allied water types. Mr. Porob has extensively worked as a Range Forest Officer in Madei Wildlife Sanctuary and has observed and studied wildlife in the natural resources of Goa many times, using modern technology. In his two affidavits, he has elaborated on how the forest in water flow due to (a) abstraction of water, (b) diversion of water, will influence the bio-diversity, botanical and zoological diversity in the State of Goa. His affidavits are premised on the fact that if the proposed project for water diversion of Mahadayi river is allowed and effected, it will be harmful for the ecology. It will affect the wildlife sanctuary and will defeat the purpose of the National Forest Policy, 1988, as also will be in contravention of certain provisions of Wildlife Protection Act. Mr. Porob has identified Mahadayi river and Surla

river as the two prominent source of water which sustain the vast bio-diversity of the Wildlife Sanctuary and Parks of the State of Goa. According to him, while the catchment area from the

Mahadayi river flowing areas is larger at approximately 206 sq.km., the catchment area which sustains bio-diversity through Surla river is smaller area of approximately 75 sq.km. Mr. Porob has specifically stated that two rivers merge in Zone 2 of the three different Zones which are marked under ecological classification for the State of Goa. The crux of his affidavit, *inter alia* ,is that if the flow of Mahadayi river is diverted/ abstracted, Surla river alone will not be sufficient to sustain the ecology of these Wildlife Sanctuaries and western Ghats, which are classified as one of the “Hottest Hotspots” in the world, will suffer irreversible damage. On the basis of certain Annexures annexed with his additional affidavit, he has also quantified the bare minimum requirement of fresh water, which is necessary to sustain the ecology in the Wildlife Sanctuaries and National Parks of Goa. Mr. Porob has also specifically pointed out that while water fed through the river is plenty during the monsoon season, as the monsoon progressively approaches the animals come to rely more frequently on the watering hole, across the Wildlife Sanctuary and Parks. As the watering holes start drying towards

the end of pre-monsoon cycle of the next year, they are again reflecting with the onset of monsoon and increases the flow of the rivers. According to him, if there is abstraction/ diversion of

water, the availability of water will become scare for all animals, thereby adversely affecting their population.

489.

Mr. Porob, has mentioned that, the total 17 water holes have been established in Madei Wildlife Sanctuary, which are fed by the water coming from river Madei, during summer. The total quantum of water, in these water holes, are shown by him in Table 1.3 at page 15 of Volume. 214. The same reads as under:-

Table No.1.3 below, shows the demand for Wildlife. Management in Mahadayi Basin is enumerated as below:-

FOREST	PRESENT WATER HOLES AND QUANTITY OF WATER	WATERHOLES AND THEIR QUANTITY ENVISAGED BY 2050
Madei Wildlife Sanctuary	17 (17x300 = 5100 Cum)	40 (40x300=12000 Cum)
Bhagwan Mahavir	13 (13x300=3900	48 (48x300=14400

Wildlife Sanctuary	Cum)	Cum)
Bondla Wildlife Sanctuary	8 (8x300=2400 Cum)	8 (8x300=2400 Cum)
Total	11400 Cum	28800 Cum

1043

490.

In paragraph 15 of his additional affidavit dated 17th November, 2017, Mr. Porob has summarized all his statements.

491.

This witness was cross examined by the learned Counsel for State of Karnataka. In response to question No.3, as to whether the witness has conducted any scientific study on the quantification of water requirement and forest, flora and fauna and the water requirements of villages in Surla valley and Kodval valley, the witness has answered the question by stating that he has not conducted such a study. In the additional affidavit filed by the witness on 17.11.2017, the witness has mentioned the quantity of water required in Table No.1.1 as 1804.336 cum (63.72 tmc), in Table No.1.3 as 28800 cum (0.001 tmc), whereas in Table No.1.4 quantity of water required is stated as 120000 cum (0.004 tmc), totaling 63.725 tmc, but no record in support of the criteria, is disclosed. Therefore, it was put to the witness that these self-serving calculations are merely ipse-dixit without any record of scientific study, and the learned Cross Examiner had

sought response from the witness.

In answer, the witness denied the suggestion. According to

him calculations given in the tables 1.1 and 1.4 were taken from

Water Resources Department of the Sate of Goa, whereas the scientific observations made by him, on day-to-day basis, on inventory of amphibian fauna of Surla and Kodval Valley, were recorded to understand the existence and dependability of this Fauna in Madei Wildlife Sanctuary.

The witness had further

stated that reduction of any amount of water, in both the valleys will result in endangering and extinction of local species of frogs known as Nyctribatricus.

492.

The learned Cross Examiner for the State of Karnataka requested the witness to refer to Volume-I of the Master Plan of Mahadayi/Mandovi river prepared by the Irrigation Department of Government of Goa and turn to page 55 and informed the witness that in para 5.6.4, the requirement of water for different uses in Mahadayi Basin up to 2050 and are calculated and at serial No.4, 50 Mcum (1.765 tmc) is mentioned against forest management, whereas in additional affidavit, the witness has claimed that, the water requirement of 0.001 tmc in table No.1.3

and 0.004 tmc in Table No.1.4, are required. Further his attention was drawn to the Master Plan, wherein it is mentioned that 158 Mcum (5.579 tmc) is required for salinity control, and thus the total water requirement for forest management, comes to 7.344

1045

tmc. Therefore it was put to the witness that if this quantification of water requirement of 7.344 tmc were to be maintained or ensured for meeting the forest management and salinity control, there would not be any adverse impact or damage to the environment and ecology in Goa. After putting the aforesaid suggestion the response of the witness was sought.

The witness denied the suggestion and stated that the quantity mentioned in the Master Plan at page 55 para 5.6.4, referred to in the question, is for forest management at serial No.4, and it should be noted that while preparation of Mater Plan, forests are taken into consideration, since Madei Wildlife Sanctuary was not notified at that point of time, the requirements of water for Wild Life and habitat maintenance, was not considered. The witness further explained that Tables 1.1 and 1.3 mentioned in his additional affidavit, show the quantum required directly by forest components of Wildlife Sanctuary.

493.

The attention of the witness was drawn to para 33 of

his affidavit dated 11.11.2017 (Volume 209) and it was put to the witness that on the one hand he has stated that the Madei

Wildlife Sanctuary has threatened species of birds, and on the other, the very document relied upon by him clearly shows that main threat to the bird heritage and flora and fauna in the Madei Wildlife Sanctuary, is human encroachment and mining, and therefore, the witness has selectively relied upon the article to show the proposed diversions of the Karnataka Government, which are likely to impact, on the forest of Mahadayi valley, but conveniently he has not adverted to, the preceding part of the article. After putting the suggestions, the response of the witness was sought by the learned Cross Examiner on behalf of Karnataka.

The witness, first of all, denied the suggestions and stated that it should be noted that there is no mining activity within the jurisdiction of Wildlife Sanctuary in Goa and hence effect of any such mining activity on avifauna in Wildlife Sanctuary is not there at all, whereas river diversion projects are upstream of Wildlife sanctuaries in Goa and also on upper stream of Bhimgarh Wildlife Sanctuary of Karnataka, which act as a Wildlife corridor for unhampered movement of macro-Fauna.

The witness has

asserted that any activity in upper stream, will result in

disturbance to the habitat of avifauna and Gene-Pool conservation will be, greatly affected.

494.

Thereafter, Shri Mohan V. Katarki, the learned Counsel for State of Karnataka closed his cross-examination. Therefore, Shri D.M. Nargolkar, the learned Counsel for State of Maharashtra was requested to cross-examine the witness on behalf of the State of Maharashtra. In all the learned Counsel had put six questions to the witness, and question No.6 was as to whether the witness agreed that any sort of diversion or utilization by any of the States, including the State of Goa, in future, in Mahadayi Basin, would result in adverse impact and would disturb the ecological balance, resulting in total disaster in Mahadayi Basin.

The witness stated that he agreed with what was stated in question No. 6.

495.

After the cross-examination of the witness, by the State of Karnataka was over, Shri Atmaram N.S. Nadkarni, the

learned Senior Counsel for State of Goa stated that he did not want any opportunity to conduct any re-examination of this

witness. Therefore few questions were put to the witness by the Tribunal to elicit certain information relating to Wildlife etc. The attention of the witness was drawn to what he had stated in para 13 on page 10 of his affidavit dated 11.11.2017, and the attention of the witness was also drawn to MARK GOA-16 (Colley), as well as National Forest Policy 1988, and witness was requested to inform the Tribunal as to whether he had examined the social and environmental costs and benefits, before arriving at the conclusion that if proposed project for diversion of Madei river water was allowed, it will be harmful to the ecology, and that it will also adversely affect the Wildlife Sanctuaries and in general defeat any principle of the National Forest Policy 1988.

In response, the witness stated that the Government of Goa has notified Forest Wildlife Sanctuary along the stretch of Western Ghats of Goa, for water security and maintaining ecological balance.

According to the witness socio-economic conditions of the inhabitants of these areas are depending on the Western Ghats in Goa, and in his earlier affidavit dated

11.11.2017 at para 46 on page 27 he had stated about man animal conflict and its implications on the socio-economic conditions of the people.

The witness proceeded to state that

1049

the water flowing out from Wildlife sanctuary is being utilised by people for cultivating which is a traditional practice and that is mentioned by him in para 55 on page 31 of his affidavit dated 11.11.2017.

496.

The attention of the witness was drawn to para 4.4.1 of the National Forest Policy 1988, and witness was asked as to whether any forest land been diverted from any non-forest purpose, either by the State of Goa or by the State of Karnataka. Another question which was asked was as to whether the diversion of forest land for non-forest purposes had resulted in any change, either increase or decrease, in the water availability, and how many projects related to dams and reservoirs, mining and industrial development, and expansion of agriculture, have been constructed in forest areas and how the availability of water has been impacted, as well the result of implementation of such projects.

The witness answered that he was not knowing if the States of Karnataka and Goa have diverted any forest land for non-

forest purposes. The witness further stated that he did not know as to whether the diversion of any forest land for non-forest

purpose has resulted in any change in the water availability, and finally he replied that he was not knowing about any project relating to dams, reservoirs, mining, industrial development and expansion of agriculture having been undertaken in the forest area, and therefore, he was not able to comment upon the impact of any such projects on the availability of water.

497.

It was brought to the notice of the witness that in several paras of his affidavit dated 11.11.2017, he has mentioned about adverse impact of diversion of water from Mahadayi Basin on forest and Wildlife, and his particular attention was drawn to para 54 on page 31 of his affidavit. He was informed that the Tribunal has noticed that the mean of the average monsoon rainfall over the Mahadayi Basin during the years from 1964 to 2005 is 3760.1 mm, and the average monsoon rainfall over the Basin, varies considerably. It was also noticed by the Tribunal that in many years there were considerable variations, in the yield with respect to yield mentioned for in the previous years, whereas there were marked variations in long term as well.

Therefore the witness was asked as to whether he had examined the impact of variations in rainfall and consequently in yield from Basin, particularly when the variations were too large, as in the

year 1971 and 1972, on the forest and wildlife. Another question put to the witness was as to how he predicted disaster for the forest and wildlife because of likely diversion of relatively small fraction of total yield of the Basin.

The witness mentioned that he is not a hydrologist and therefore is not in a position to answer the first question. The witness proceeded to state that as far as forest and wild-life is concerned, any diversion of water coming to the forest will still result in reduction of water and will also reduce water velocity, which in turn, will harm dissolving of minerals and transportation of organic matter from one area to another and that this has been explained in detail, in para 26, on pages 16, 17 and 18, of his affidavit dated 11.11.2017.

498.

The Tribunal finds that the veracity/authenticity of the figures relied upon by the Water Resources Department, State of Goa, having not been questioned/challenged or discredited by the learned Counsel for the States of Karnataka and Maharashtra, the reliance of Mr. Porob, on such figures may, therefore, be

taken, as correct, for the purpose of his statements. It is pertinent to note that, in answer to question No.3 put by the

Tribunal, the witness has stated that, while preparing his affidavit, he had taken into consideration, provisions mentioned in National Forest Policy, 1988, and the Tribunal finds that, the various aspects mentioned in National Forest Policy, 1988, were taken into consideration by this witness with reference to ecology or the developmental requirements, to be maintained in the States of Karnataka and Maharashtra.

499.

In view of the above discussions, the Tribunal concludes that the testimony of this witness, can be acted upon, subject to availability of changes in quantum related information, in other witness's statements/submissions, put forth, on behalf of the State of Goa.

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - VI

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – VI

Sl. No.

1.

D E S C R I P T I O N

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the State of Goa**
- **Evaluationof oral evidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa**
- **Evaluationof oral evidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa**
- **Evaluationof oral evidence of RW-3 Shri S.M. Jamdar for the State of**

Karnataka

Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

1053 - 1058

PAGE NOS

1058 - 1066

1066 - 1085

1085 - 1093

1093 - 1103

- **Evaluationof oral evidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra**

2.

Decision and findings by the Tribunal on important questions.

- **Prejudice**
- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**
- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project**

implementation.

1103 - 1110

1110 - 1132

1132 - 1201

1201 - 1224

1225 - 1248

1249 - 1290

b

1053

EVALUATION OF THE ORAL EVIDENCE LED BY THE THREE PARTY-STATES CONTD…..

Evaluation of oral evidence of AW-3 Dr. Shamila Monteiro for the State of Goa

500.

Dr. Shamila Monteiro also deposed as a witness on behalf of the State of Goa, on the aspects relating to the adverse consequences, which would ensue in case of the proposed water diversion plans of the States of Karnataka and Maharashtra, being given effect to. Dr. Monteiro has obtained advance academic degrees in the field of fisheries and has undertaken research on life cycle, behavior, population dynamics and fish catching trends on various varieties of fish found in Goa. In her affidavit Dr. Monteiro has emphasized the importance of flow of organic materials from the fresh water of river Mahadayi in the estuaries and coastal regions in the State of Goa. She has extensively deposed as to how the flow of such organic material, minerals and nutrients impact the salinity of water conditions, climatic conditions, terrestrial and soil conditions, availability of

phytoplankton and consequently impact, amongst other things, the feeding and breeding patterns of varieties of fish in the estuary coastal regions. According to Dr. Monteiro, in the natural variations in the mixing of fresh water of the river with the saline

water of the Arabiansea in these steroid regions, significantly impacts both the progency of these fish varieties, and also fishery techniques and the quantum of fishing, which is undertaken by the local population in the State of Goa. According to her, approximately 71,000 kg. of fish is caught by the local fishermen only during the non-monsoon season. This catch goes up to about 1.00 lakh kg. during monsoon season. According to Dr. Monteiro, the abstraction/diversion of water by the State of Karnataka will severely impact the survival of these fish, both for the purpose of maintenance of natural habitats, and also on the livelihood of local consumption of fish by the local population, especially in the villages surrounding these regions. Dr. Monteiro has categorically stated that the consumption of fish by the local population in Goa is higher than the national average, so as to signify the importance and relevance of the fish in daily diet habits of the local population.

501.

Few questions were put to the witness by the learned Counsel for the State of Karnataka. The attention of the witness

was drawn to page No. 55, paragraph 5.6.4 of Volume-I of the Master Plan of Goa (Annexure 120 of Volume 31), wherein the water requirement for salinity control in the estuary is

1055

mentioned as 158 Mcum (5.58 tmc) and, therefore, it was pointed out to the witness that the estimation made in the Master Plan is on the liberal side, compared to what is calculated by the State of Karnataka in its Worksheet, MARK-KA/17. Having drawn the attention of the witness to the above stated facts and suggestions, it was put to the witness that she should at least accept, what is stated in the Master Plan.

The response of the witness was that the Master Plan, Volume I, GOA, was prepared in the year 1999 and, therefore, the figure mentioned therein did not relate to the salinity required by the aquatic biodiversity, because, perhaps at that point of time, the aquatic biodiversity may not have been considered.

502.

Thereafter, Shri Mohan V. Katarki, learned Counsel for the State of Karnataka stated that he had no further questions to ask to this witness in her cross-examination and, as such, he closed his cross-examination.

503.

Thereupon, Shri D.M. Nargolkar, learned Counsel for

the State of Maharashtra was requested to cross-examine the

witness.

Shri Nargolkar, learned Counsel for the State of Maharashtra had put only one suggestion to the witness that her claim that diversion of 2.83 tmc by the State of Maharashtra, outside the Mahadayi basin, which is relatively a small fraction of the total yield of the basin, would change the flow of the river affecting fisheries, biodiversity and aquatic habitat isnot ecologically sound and is without any justification and basis and is based on wrong assumption. The witness had denied this whole suggestion.

504.

Thereafter, few questions were put to the witness by the Tribunal to elicit better particulars from her. It was put to the witness that whether had she studied the impact of relatively lesser availability of water, during the year or during the cycle of years with less flows. Another question, which was put to the witness, was as to whether she had studied, the impact of relatively higher availability of water, during a year or during a cycle of the years with higher flows. Her answers were that she

had collected the statistical data of fish production, as per the CMFRI method and had observed that there is higher production, post a very good rainfall, especially, with respect of Sardine Fishery and Shrimp Fishery.

505.

The Tribunal wanted to know, from the witness as to whether she had undertaken or been part of the socio-economic evaluation of various schemes/projects related to utilization of water for various purposes. She was also requested to give her opinion as to what should be the permissible limit for abstraction of water, which is being used and which will be continued to be used as well as utilization is likely to increase in future, to meet the social need.

In her answer, she mentioned that, she has only collected the water requirement for aquatic biodiversity in the Mahadayi Basin. She expressed her opinion by stating that pristine areas such as biodiversity hot spot, etc. in upstream reaches, need to be protected to its natural flow for future generations.

506.

The Tribunal finds that the methodology or the data collected pursuant to such methodology has not been assailed/ challenged by the learned Counsel for the State of Karnataka or the State of Maharashtra. The Tribunal, therefore, concludes that

the statement, data and the assessment of quantum of water requirement to maintain the fisheries under the present

condition, provided by Dr. Monteiro are reliable and should be taken into account while computing the water requirements of the State of Goa.

Evaluation of oral evidence of AW-4 Shri Rajendra P. Kerkarfor the State of Goa

507.

Shri Rajendra P. Kerkar, AW-4, is examined, as an Expert Witness, on behalf of the State of Goa, on the topic of "Environment, Ecology and Forest". Shri Kerkar, is presently, working in the awareness of environment, wildlife and forest related issues in the State of Goa and border areas, since more than last 50 years. His works and contribution in the above mentioned fields, are enumerated, in his Affidavit-in-Evidence filed on 13 th November, 2017. Therefore, having regard to his expertise, the State of Goa had requested Shri Kerkar in April 2013, to depose before the Tribunal as an Expert Witness, on Environment, Ecology and Forest, on behalf of the State of Goa.

508.

Shri Kerkar has filed his Affidavit-in-Evidence on

13 th November, 2017. In the said affidavit Shri Kerkar has highlighted several environmental issues, to show that the

Western Ghats and especially the Mahadayi River Drainage area, is of a highly sensitive region, and any disturbance, by any activity, namely, diversion of the Mahadayi waters, will inevitably destroy, its rich habitat vis-à-vis its ecological balance. He has stated that any abstraction or diversion of the river, which flows through six Sanctuaries, should be prevented, so as to protect these Sanctuaries, and also to maintain the precious ecology.

509.

Shri Kerkar has also filed, an Additional Affidavit-in-Evidence before the Tribunal on 17 th November, 2017. Annexure I, to the said Additional Affidavit-in-Evidence, contains a Table prepared by him, which shows the impact that would take place, on account, of the proposed diversions/ abstraction of water, on the Wildlife Sanctuaries. He has stated that, the coastal economy system is a fragile eco-system generally, and it, being an integral part of the Western Ghats, any diversion of water, would increase the salinity, thereby adversely affecting, the coastal eco-system, which is a fragile eco-system. The witness states that, requirement of e-flow, in the wildlife sanctuaries would be much

higher, and that the water coming into a wildlife sanctuary, cannot be diverted at all, in view of the complete bar contained in section 29 of the Wildlife (Protection) Act, 1972.

510.

The witness was cross-examined by Shri Mohan V. Katarki, learned Counsel for the State of Karnataka. In response to question No.5, Shri Kerkar denied the suggestion that when one applies water to land, more than its requirement, it becomes saline and water logged, and when the land is deprived of the minimum necessary requirement of water, it becomes a degraded or barren land. According to him, in case, excess water is supplied to some lands, then in the absence of forest cover, the land would become saline.

511.

The testimony of Shri Kerkar indicates that he had visited the areas of Malapraba basin in Karnataka and according to him, the adverse situation, namely scarcity of water is, due to mismanagement of available water resources, and degradation of catchment area of the river Malaprabha in the State of Karnataka, through the activities of deforestation. This becomes evident, if one refers to his answer to question No.8, put to him, on behalf of the State of Karnataka. The witness has further

established the effect of scarcity of water for the people residing within Malaprahba basin is, because of opting for water guzzling cash crop like sugarcane. In answer to question No. 13 put to

him, Shri Kerkar has explained the e-flow in monsoon and non-monsoon seasons, based on the software, developed by the International Water Management Institute, as according to him, he has found the methodology used by the said Institute, more reliable. In answer to question No. 14, Shri Kerkar has vehemently asserted that the Mean Annual Flow, calculated by him, is completely reliable. From answer to question No. 15 put to him, it becomes evident that Shri Kerkar has used, the yield study done by Shri ChetanPandit and the Water Balance Analysis done by Shri S.T. Nadkarni. It is also evident that, for operating software, he has taken assistance of the officials of the Water Resources Department of the State of Goa. In answer to question No.16, Shri Kerkar has firmly, stated that, he has not taken into consideration, the CWC (2003) Report, as according to him, the figures mentioned in the said Report are unrealistic.

512.

Shri Kerkar has asserted that the e-flow, is not less than 25.4 tmc for 10 Sub-Basins in Mahadayi. In this context, a suggestion was made on behalf of the State of Karnataka that

even if, it is assumed that 25.4 tmc is reserved towards requirement of e-flow, even then there would not be any injury to environment and ecology in Goa, because if the total available

water, estimated by the CWC in its Report is considered, there would be sufficient water, to accommodate the total planned diversion of Karnataka of 14.98 tmc, out of 75% dependable flow. The Tribunal notices that Shri Kelkar has vehemently denied this suggestion and stated that Mahadayi basin is water deficient.

513.

In response to question No. 19, Shri Kerkar has denied the suggestion made on behalf of the State of Karnataka, that Karnataka is planning diversion from Kotni, out of surplus flow and has firmly stated that so called surplus flow at Kotni will hardly, be available. In response to question No. 20, the witness has stated that 75% dependable yield as computed by the State of Karnataka is unrealistic, whereas in response to question No.21, the witness has asserted that DHI (India) Water and Environment Pvt. Ltd. is a well known and renowned developer, of highly Sensitive and Precise Engineering Software MIKE series, for simulation of engineering data and that the Report of DHI is reliable. In question No.22, Shri Kerkar’s expertise and competence to analyse and support or defend the study

conducted by DHI (India) Water and Environment Pvt. Ltd. was questioned, since he lacks the qualification in Science. However, Shri Kerkar has firmly answered that, while he does not have the

basic qualification of a degree in Science, he does have the ability and interest to understand the subject matter and interact with the qualified persons.

514.

Further, Shri Kerkar has clarified, while answering questions put to him, on behalf of the State of Karnataka that, in the context of the unique eco-system, like Myristca Swamps, there are no guidelines or norms duly approved, by the competent authority. He has suggested that in cases where the non-monsoon flow is, to the tune of maximum of 2% of the monsoon yield, the environmental flow should be 100%. The witness has vehemently stated that these are red-listed and relics of pre-historic vegetation, when human beings were not there on the earth. The witness has further emphasized that there is a need to identify such areas, in various parts of India and provide a mechanism of protection and conservation.

515.

After the cross-examination of the witness on behalf of the State of Karnataka, was over, a question was put to the

witness, by the learned Counsel for the State of Maharashtra. In answer to question No.1, put to the witness, on behalf of the State of Maharashtra, the witness has strongly denied

thesuggestion that the diversion of 2.83 tmc, by the State of Maharashtra, outside the Mahadayi basin would not result in irreversible damage to the environment, destruction of the rich habitat and disruption of its ecological balance.

516.

Thereafter certain questions were put to the witness by the Tribunal.

517.

On being questioned about his stand, on diversion channel constructed by the State of Karnataka at Kankumbi, Shri Kerkar has reiterated that the said construction has interrupted, the downstream flow of river Kalasa and he has been witnessing, the death of the pristine tributary, going in the direction of the Madei Wildlife Sanctuary in Goa, right from, inception of Kalasa canal, since 2006. The witness has further mentioned that during the last two seasons, the perennially flowing Surla waterfall dries up by the end of the month of May and the base flow at the swamps has dwindled, to an alarming level.

518.

Further, the Tribunal notices that contrary to the testimony of Shri Kerkar, the Master Plan of 1999 acknowledges the projects, within the State of Goa, that would utilize up to 94.4

tmc of water from Mahadayi basin, though according to the State of Karnataka the present utilization of the State of Goa is 9.395 tmc of the Mahadayi water. The Tribunal notices that the storage facilities, which may be created, in respect of water available, would have an environmental impact, which is balanced against the developmental needs. Further the testimony of Shri Kerkar shows that there are more than 200 different approaches to estimate the e-flow and on being asked as to why he had used a particular software to calculate the e-flow, he could not give specific reasons for preferring the software that he had used, but simply stated that the methodology used by the International Water Management Institute is more reliable, without assigning any reason as to why and how the said methodology is more reliable compared to other methodologies. Further Shri Kerkarhas stated that he has ‘Biophilic Feelings’ (para 4). Thus the Tribunal finds that his evidence lacks the objectivity and has no scientific basis. In fact, in response to question No.23, the replygiven by the witness, indicates that, Goa plans to utilize 72.4 tmc for irrigation, and has stated that he would always make the

attempts to understand the need of the hour and if the plans are against the wildlife and ecology, he would always oppose the same as he had opposed in the past and shall continue to oppose

the same in future also. Thus impact of proposed utilization of 72.4 tmc, by Goa, on wildlife and ecology is not examined by this witness.

Further the Tribunal notices that the Tribunal had brought to the notice of the witness, the observations of the Research Paper 107 of IWMI, wherein, it is, inter alia, stated that the data which have been acquired and used were, primarily from publicly available sources, and data are outdated and no conclusions on the accuracy or even origin of the data could be made. The Tribunal notices that the witness could not offer any cogent reasons given in Research Paper 107 of IWMI.

519.

In view of the above inconsistencies and deficiencies, which are found by the Tribunal, in the evidence adduced by Shri Rajendra P. Kerkar, the Tribunal does not consider it to be prudent to rely upon the same.

Evaluation of oral evidence of AW-5 ShriSubrai T. Nadkarnifor the State of Goa

520.

Shri Subrai T. Nadkarni, (AW5), is an expert witness, examined on behalf of the State of Goa on “Hydrology”. Shri Nadkarni is holding the post of Chief Engineer, Water Resources Department, Government of Goa. Therefore, Shri Nadkarni is

examined before the Tribunal as an expert witness on Hydrology and other related aspects, especially to prove Goa's needs and projects.

521.

Shri Nadkarni has filed his Affidavit-in-Evidence dated 14.11.2007 (Volume 208). Along with his Affidavit, Shri Nadkarni has relied upon the following documents:-

i.

ii.

CV of Shri Nadkarni, produced at Annexure I,

Water Demand and Availability for Mahadayi Basin and its Sub Basins, which is a report prepared by Shri Nadkarni, and is produced at Annexure II.

522.

Shri Nadkarni has also produced a report of the Western Ghats Ecology Expert Panel, submitted, to the Ministry of Environment and Forests, Government of India.

523.

The witness has further produced "A REPORT OF THE

HIGH LEVEL WORKING GROUP ON WESTERN GHATS", issued by the Ministry of Environment and Forest, Government of India, on 15.04.2013.

1068

524.

From his testimony, it is evident that, Shri S.T. Nadkarni has worked out the water availability, in the sub- basins in respect of utilizable catchment area, in the Mahadayi Basin. The attempt of the study, undertaken by Shri Nadkarni, is to emphasize that the Mahadayi Basin, is water deficient basin, taking into consideration, the demands of the State of Goa. The table, which has been worked out by Shri Nadkarni, is to be found on page 15 of his evidence and the same reads as under:

Basin	Availability in Mcum (75% dependable)	Demand in Mcum	
		Recommended	Minimum required
Ragada	465.40	338.69	254.59
Khandepar	803.10	835.29	689.59
Kotrachi	219.30	273.28	229.38
Valvanti	214.90	183.28	144.98

Bicholim	210.20	159.06	121.66
Asnora	81.70	130.36	114.96
Surla	259.90	204.81	151.31
Siquerim	-	19.16	19.16
Kudnem	77.00	167.47	153.47
Madei stem	951.80	1769.02	1592.42
Total	3283.30	4080.42	3471.52

1069

525.

From the above mentioned table, it becomes evident that Shri Nadkarni has concluded that the sub-basin wise, water availability, is 115.94 tmc (3283.3 Mcum) and the sub-basin wise demand, which is recommended, is 144.08 tmc (4080.42 Mcum). The table further indicates that, according to Shri Nadkarni, the minimum water requirements are 122.58 tmc (3471.52 Mcum). Further, in his affidavit dated 14.11.2017 (Volume 208), Shri Nadkarni, has worked out following:

(i)

(ii)

Population projections in paragraph 21 on page 43;

Domestic water requirement in paragraph 22 on page 43;

(iii) Tourist arrivals and stay in paragraph 24 on pages 44-45;

(iv) Irrigation requirements in para 23 on pages 43-44;

(v)

Industrial requirement in paragraph 25 on page 45;

(vi) Water requirement for livestock in para 27 on page 46;

(vii) Sub-basin wise water availability in tables 1 to 8 on pages 47 to 62; and

(viii) Environmental Flow requirements, as have been estimated by Shri Rajendra P. Kerkar, AW4, on page 41 of his Affidavit dated 11.11.2017 (Volume 211).

1070

526.

Shri Nadkarni has also worked out the water requirements in table 10, 11 and 12 and has calculated the water balances in Table 13 of his Affidavit dated 14.11.2017. The same is extracted below:-

(inMcum)

Sub-basin	Human Needs				Environment	
	Domestic (from Table 12 of Vol. 208)	Live stock (from Table 12 of Vol. 208)	Irrigation (from Table 11ofVol. 208)	Total human needs (Sumof Col.2+ Col.3+ Col.4)	Recommended	M (T 1 V
1	2	3	4	5	6	7
Ragada	0.477	0.07	142.21	142.757	195.93	1
Khandepar	3.962	0.59	491.54	496.092	339.20	1
Kotrachi	0.616	0.09	170.32	171.026	102.25	5

Valvanti	0.912	0.14	93.15	94.202	89.08	5
Bicholim	1.413	0.21	70.34	71.963	87.10	4
Assnora	1.212	0.18	93.15	94.542	35.82	2
Surla	0.325	0.05	79.92	80.295	124.51	7
Siquerim	2.554	0.38	16.23	19.164	0.00	0
Kudnem	1.980	0.30	132.44	134.72	32.75	1
Madei Stem	22.521	3.38	1162.43	1188.33	411.20	2
Total	35.97	5.39	2451.73	2662.58*	1417.84	8

1071

(*Total human needs includes 50 Mcum of water for Forest Management, 23.07 Mcum of water for Tourism and 96.42 Mcum of water for Industries)

527.

Shri Nadkarni was cross-examined by Shri Mohan V. Katarki, learned Counsel for the State of Karnataka.

528.

From the answer given by the witness to question No. 1, put on behalf of the State of Karnataka, it is evident that the witness has utilized the processed data of Shri ChetanPandit and used his regression equation to arrive at the 75% dependability of yield in the Sub-basin.

529.

Further, in his answer to question No. 1, he has declined the suggestion that Shri ChetanPandit's regression analysis is misleading and cannot be accepted and that he has failed to carry out the consistency check on the rainfall data.

530.

The witness has stated that Surla River flows through

the Mahadayi Wildlife Sanctuary and that any diversion of water, flowing into or outside, is not permissible as per Section 29 of the Wild Life (Protection) Act, 1972.

1072

531.

In answer to question No. 9, the witness has mentioned that it does not matter whether a rain-gauge station lies in or outside a basin, but the only relevancy is that it should have influence on the basin.

532.

In answer to question No. 13, the witness has stated that the area of 509 sq.km., is the area, which excludes the saline reaches of Mahadayi river and its tributaries and even small rivulets falling directly into the sea/ saline reaches.

533.

In his reply to question No. 16, the witness has stated that he has only considered the regression equation, generated by Shri ChetanPandit to arrive at 75% dependable availability of sub-basin wise.

534.

In question No. 16, the attention of the witness was drawn to the alternate study Report on Sonal-I Hydro-Electric Project [Volume 103(ii), page 64], filed by the State of Goa and a

suggestion was put to the witness that barring one or two years, the correlation is quite good and that there is consistency between runoff and rainfall at Ganjim site. In answer thereto, the

witness has stated that he does not subscribe to the observations made by NHPC.

535.

In question No. 19, the witness was confronted with a list, wherein projects contemplated and proposed by the State of Goa, in the area of 509 sq.km. are mentioned. Having drawn the attention of the witness to the said list, a question was put to the witness to the effect that if the water generated in the zone of 509 sq.km. is not utilizable and cannot be treated to be a part of yield, then how the State of Goa has planned these projects. The answer given was that many of the projects listed therein, either do not lie in the 509 sq.km., but some minor schemes like very small bandharas, ponds are included in the said 509 sq.km. zone and that the small quantum of water available is mainly used for protective irrigation. The witness has further stated that the projects listed at serial Nos. 1, 2, 3, 5 and 7 are lift irrigation schemes and all the water supply schemes, do not lie within the 509 sq.km. zone.

536.

From the assessment of the evidence, tendered by Shri Nadkarni, it is evident that, in answer to question No. 1, put to him by the learned Counsel for the State of Karnataka, he has

analyzed CWC Study (2003), and also the Study conducted by Shri ChetanPandit and his observations, on the same, are reflected in his study (Annexure II), in paragraph 9 on pages 31-32 and in paragraph 12 thereof on pages 39-42. According to him, what he has done is that, he has utilized the processed data of Shri ChetanPandit and has used, his regression equation, to arrive at 75% dependability of the yield in sub-basin. It was put to the witness that the total utilization planned by the States of Karnataka and Goa is 5.82 tmc in Surla Sub-basin and, therefore, even after considering his calculation of Surla Sub-Basin, as 9.20 tmc and even after considering the utilization of 5.82 tmc, planned by both the States, there would be, still a surplus of 3.38 tmc for meeting the needs of environment concerns and, therefore, there would not be any damage or adverse effect on the ecology and environment in the Surla valley, on account of diversion, planned by the State of Karnataka. The response of the witness was that what is being compared is only the irrigation requirement in Table 11, which is on page 64 and he reiterated that, Surla River, flows through the Mahadayi Wild Life Sanctuary

and any diversion of water, flowing into or outside, is not permissible in view of Section 29 of the Wild Life (Protection) Act, 1972. According to him, though some surplus water looks

apparent, the whole Mahadayi system has to be looked into as a whole, before deciding about any diversion. The Tribunal notices that while dealing with the question of diversion, the witness speaks of whole Mahadayi system, whereas for his assessment of the yield, the witness has divided Mahadayi Basin into sub-basins, which is a contradiction in itself.

537.

Before putting question No. 13, the witness was shown extent of saline area, in the State of Goa, as indicated in the National Wetland Atlas, prepared by the Space Application Centre, Indian Space Research Organization, Ahmedabad. It was put to the witness that the wetland in Goa is not more than 8,486 hectares and as compared to geographical area of 3,70,200 hectares, as indicated in MARK-KA/22, it forms only 2.29% and on this basis, the saline area, comes to only 36.18 sq.km. Having brought the relevant facts to the notice of the witness, it was put to the witness that Goa is unjustified in claiming exclusion of 509 sq.km. (50,900 hectares), from consideration, in the estimation of the total yield of Mahadayi basin and response of the witness

was sought, by the learned counsel for the State of Karnataka.

1076

In answer, the witness has stated that the area of 509 sq.km. is absolutely justified to be deducted from consideration, in the estimation of the total yield of Mahadayi basin. The witness has further stated that he had extensively moved in basin, especially in the estuarine region and the area of 509 sq.km. is the area which excludes the saline reaches of Mahadayi river and its tributaries and even small rivulets falling directly into the sea. The witness further has mentioned that the Atlas, MARK-KA/21, is regarding the wetlands, identified by the National Wetland Atlas and, in no way, it delineates, the saline reaches, in the State of Goa and especially in the Mahadayi basin.

538.

In question No. 15, it was pointed out to the witness that the water utilization planned by Goa, in the Master Plan, is 2050 Mcum (72.4 tmc), but the DPRs, filed by the Goa, are only in respect of 62 projects, for utilization of 29.72 tmc, as shown in MARK-KA/23. Therefore, it was put to the witness that by failing to file DPRs, in respect of 42.68 tmc, the Goa has abandoned its claim to that extent and the response of the witness was sought

regarding this aspect of the matter.

1077

In answer, the witness mentions that the demand of Goa, go well, beyond the DPRs of 61 projects envisaged in the Master Plan. However, the witness could not give any details to demonstrate that the demands of the State of Goa, go well beyond the DPRs of 61 projects. As a matter of fact, the witness, in reply to question No. 6, put by the Tribunal, has stated that "the State of Goa intends to meet the demand for major uses through the 61 projects identified by Panel of Experts". He further stated that in case of some of the demands, it is not possible to prepare the DPRs, such as environment demands, tourism demands etc. and that attempts are being made to identify more projects, especially like abandoned mining pits, construction of bandharas, etc. for fulfilling the demands.

539.

In answer to question No. 16, the witness has stated that he had only considered the regression equation, generated by Shri ChetanPandit, to arrive at the 75% dependable availability sub-basin wise, adopting the processed rainfall data.

540.

In answer to question 19, the witness has mentioned that he has gone through the list of projects, completed and also proposed, by the State of Goa in the area of 509 sq.km., which

are listed in the document MARK-KA/24,, which was handed over to him, and he has stated that many of the projects listed therein, either do not lie in the 509 sq.km. area and some minor schemes like very small bandharas, ponds are included in the said 509 sq.km. zone. The witness has further stated that the small quantum of water available, is mainly used, for protective irrigation. The witness has further added that, the projects listed at Sl. No. 1, 2, 3, 5 and 7, are lift irrigation schemes. The Tribunal notices that though the witness has claimed that some minor schemes like very small bandharas, ponds etc. are included in the said 509 sq.km. zone, the witness has failed to bring to the notice of the Tribunal, the particulars, such as, storage capacity of bandharas, ponds etc. and in which manner the so called small quantum of water available, is used for protective irrigation. On the basis of information, provided by the witness, in answer to question No. 19, the exclusion of 509 sq.km. area does not stand justified at all.

541.

After the cross-examination by Shri Katarki was over,

certain questions were put to the witness by Shri D.M. Nargolkar, the learned Counsel for the State of Maharashtra. After cross-

examination, on behalf of the State of Maharashtra, was over, certain questions were put to the witness by the Tribunal.

542.

Some questions were also put to the witness by the Tribunal to elicit better information. In question No. 1 it was put to the witness that, has any scientific study been undertaken and/or completed, by the Government of Goa, to examine the impact of diversion of water, outside the basin and/or extraction of water within the basin by co-basin States including the State of Goa, for meeting the demand of water, for various purposes, such as drinking water, irrigation, power generation, industrial needs, navigation etc. The Tribunal notices that answer of general character is given by the witness and he has failed to point out that any scientific study was undertaken and/or completed, by the State of Goa to examine the impact of diversion of water, outside the basin, and/or extraction of water, within the basin, by co-basin States.

543.

In question No. 3, put by the Tribunal, the witness was

asked as to why he had undertaken sub-basin wise assessment of water availability at 75% dependability to arrive at a new yield figure for the Mahadayi basin. The answer of the witness was

that he had carried out the arithmetic by adding up the 75% dependable figure to find overall excess/deficiency. He has further stated that for the whole basin, the overall 75% dependability, will be the effect of 13 Stations, as evaluated by Shri ChetanPandit, and he stands by the yield determined by Shri ChetanPandit, at 113.5 tmc, for the whole basin. The witness has further mentioned that he had undertaken, sub-basin wise study, as he wanted to evaluate as to what would be the effect of availability and demands in each sub-basin. The witness could not furnish any reason why he wanted to evaluate as to what would be the effect of availability and demands, in each sub-basin. The Tribunal notices that sub-basin study has many drawbacks and is likely to mislead one, who reads the same.

544.

In question No. 4, the attention of the witness was drawn to Table mentioned in paragraph 30, which is on pages 14 and 15, and to Table No. 13, which is on page 65 of his Affidavit dated 14.11.2017 and, thereafter a question was put to the witness as to why he had computed the demand of water for

various purposes for the State of Goa only. It was also brought to the notice of the witness that, for proper appreciation of the water balance, of different sub-basins of Mahadayi basin, it is

essential to assess the water availability for each of the sub-basins, after considering the total area of the sub-basin, as also the complete demand of water, for each of the sub-basins, irrespective of the State boundaries. Having drawn the attention of the witness to the above mentioned facts, a question was put to him as to why he did not choose to consider the total area of the sub-basin, falling in all the co-basin States. It was also pointed out to him that it was noticed by the Tribunal that the overall demand for water is more than the availability of water and that all the identified demands cannot be fully met.

The answer of the witness was that his study was, basically to study, the demands of each sub-basin. The witness has mentioned that the in-basin demands of Karnataka were 1.857 tmc and that of Maharashtra were 3.53 tmc, as envisaged in the respective Statements of Claim. He has further stated that he had tried to find out sub-basin wise details, but he could not find the same in the documents and, therefore, he had restricted himself, to the in-basin demands, of the State of Goa itself.

1082

545.

The Tribunal finds that the approach adopted by the witness, relating to yield, on the basis of sub-basin, is totally incomplete and lopsided. Further, the reason given by the witness, for not computing sub-basin wise demand of water, for the area lying in the States of Karnataka and Maharashtra, does not represent a correct picture of the water balance of the sub-basin. The non-consideration of the total area of the sub-basin, falling in all the co-basin States, for assessment of water availability, as well as demands of water, for various purposes, makes his exercise futile and is of no assistance to the Tribunal and does not project the correct picture of the water balances of the sub-basins. The Tribunal further notices that the demand for various sub-basins, as mentioned by the witness, does not indicate the names of identified projects/ schemes for meeting the identified demands, as was done by the Panel of Experts, constituted by the State of Goa. The Tribunal is of the opinion that the identification of projects/ schemes, is necessary because, only then, it will be possible to assess the usable water, out of the

available water. The Tribunal also notices that no reasonable explanation could be given by the witness as to why assessment of sub-basin wise water availability and water demands, instead of assessment of project-wise water availability and water

demand was considered necessary. The Tribunal also notices that restricting the planning to sub-basin will put severe restrictions in planning, for optimal utilization of water resources of Mahadayi basin. No reasons are given by the witness at all as to how and why restricting the planning to sub-basin will not put severe restriction in planning, and for optimal utilization of water resources, in Mahadayi basin. As admitted by the witness himself, while indicating water demands of Goa in Mahadayi basin, in respect of domestic supply, the live stocks, tourism, industries, irrigation, forest management, and environment in the territory of Goa, the witness has not mentioned the water requirements of Goa for Hydropower development at all.

546.

In answer to question No. 13, the witness has mentioned that the Government of Goa has not carried out any scientific study relating to sea level increase salinity ingress in coastal areas of Mahadayi river. and increased

547.

The witness has, further, in answer to question No. 14, admitted that in-depth scientific evaluation of prioritization was not undertaken by him, for various uses of water, with due consideration to social, economical and environmental aspects.

1084

548.

Further, in answer to question No. 16, the witness has stated that Government of Goa has not examined and/or undertaken scientific studies about the effect of diversion of water by States of Karnataka and Maharashtra, on the agriculture of Mahadayi River Basin in the State of Goa.

549.

The witness has also admitted, in answer to question No. 17 that the State of Goa has not commissioned any scientific studies, regarding the impact of diversion of water by the States of Karnataka and Maharashtra, on the ground of water flow pattern.

550.

The Tribunal finds that the testimony of witness Shri Nadkarni is full of inconsistencies and does not provide necessary information, which would be important from the view point of determining the issues raised by the Tribunal. The witness has admitted that at least six proposed projects of Goa fall within the

Madei Wild Life Sanctuary but has failed to inform the Tribunal as to what is the nature of those projects and what quantity of water would be needed for those projects and whether the Madei Wild Life Sanctuary would be adversely affected or not.

1085

The assessment of yield of Mahadayi basin, on the basis of sub-basin yield and that too by using the regression equation developed by Shri Pandit for the catchment area, uptoGanjim, is not recognized in any approved literature on Hydrology. On overall view of the matter, the Tribunal finds that the testimony of Shri Nadkarni is of little assistance to the Tribunal in adjudicating the disputes, which are framed and, therefore, the Tribunal finds that it is not prudent to act upon the testimony of Shri Nadkarni.

Evaluation of oral evidence of RW-3 Shri S.M. Jamdarfor the Stateof Karnataka

551.

Shri S.M. Jamdar, RW3, witness for the State of Karnataka, has deposed before the Tribunal, with respect to the topic ‘Drought Prone Areas and Hydro Power Projects’. From his testimony it is evident that he is a retired Indian Administrative Service Officer, allotted to the Karnataka Cadre and in Karnataka, he held the post of Principal Secretary to the Government of Karnataka, in the Revenue Department from 2004 to 2008 and in

the Home Department in the year 2012.

1086

552.

It is further evident from his affidavit that he had occupied the post of the Managing Director of the Karnataka Power Corporation Ltd. and, therefore, he was requested by the Government of Karnataka to depose before the Tribunal, in this Inter-State Water Dispute with regard to Mahadayi River.

553.

Shri Jamdar has filed his Affidavit-in-Evidence dated 09.11.2017, on behalf of the State of Karnataka. In his Affidavit-in-Evidence, he has stated that he is deposing on three questions, namely:-

(1)

Whether, the Taluks of Bailhongal, Ramdurg and Saundatti of Belagavi District, Badami Taluk of Bagalkot District and Ron Taluk of Gadag District are drought prone areas?

He has stated that Bailahongal, Ramdurg, Saundatti and Ron are drought prone areas and one Taluk of Badami is a desert area. The witness has relied on a

chart, of various Taluks, declared as drought affected, by the Government of Karnataka, in the Malaprabha Basin.

1087

(2)

Whether, by transfer of 5.527 tmc of Mahadayi water, more power can be generated on the existing infrastructure of Kali Hydro Electric Project.

Shri Jamdar states that at present in Karnataka, there is severe shortage of power availability and that this shortage has been mounting steadily.

(3)

Whether, the Mahadayi Hydro-Power Project (Kotni HEP), which is non-consumptive, is feasible for augmenting the power, to meet the peak demand in Karnataka.

554.

Along with his affidavit dated 09.11.2017, Shri Jamdar has also relied on following documents:

(a)

A Chart of rainfall data prepared by the Karnataka State

Natural

Disaster

Management

Centre,

Bengaluru, showing, the percentage of departure,

from normal, in South West Monsoon available in

Malaprabha Basin.

(b)

A chart of various Taluks stated to be declared as

drought affected, by the Government of Karnataka, in

Malaprabha Basin, from 2001 to 2016, and stated to

1088

have been prepared by the Karnataka State Natural Disaster Management Centre, Bengaluru.

555.

The witness was cross-examined by Shri DattaprasadLawande, the learned Advocate General for the State of Goa with regard to, inter alia, his affidavit and documents relied upon by him. The witness was, further put, certain questions by the Tribunal to elicit the best information from the Witness.

556.

On assessment of the evidence of Shri Jamdar, the Tribunal finds that, Shri Jamdar presents a completely different picture with regard to drought prone areas and drought affected areas, in his cross-examination. The Tribunal also notices that Shri

Jamdar has neither examined nor specified, the reason for shortage of power availability and why faulty planning and mismanagement could not be one of the reasons, for the same. The Tribunal further finds that the witness has also neither examined nor shown to the Tribunal whether there is any other source that can be tapped or utilized for augmenting the power needs of Karnataka nor he has shown how and why only trans-basin diversion, can suffice such a need.

1089

557.

On perusal of the cross-examination, the Tribunal notices several inconsistencies and errors, in the answers given by the witness, in his cross-examination. The same are in stark contrast to the case put forth by the State of Karnataka and presents a completely different picture than that depicted by the State of Karnataka, before the Tribunal. The Tribunal enumerates the same below:

(a)

In the Affidavit-in-Evidence of Shri Jamdar, as well as in response to question No. 1, asked by the Tribunal to Shri Jamdar, he has categorically stated that the proposed diversion from the Mahadayi Basin, to the Malaprabha Basin, is for the purpose of overcoming shortfall in irrigation to the drought prone area and not for drinking water purposes as claimed by the State of Karnataka.

(b)

Shri Jamdar was specifically asked question No. 12 by

the State of Goa, about the apparent contradiction in the case put forth, by the State of Karnataka. The contradiction is that, the State of Karnataka has claimed a quantum of 7.56 tmc, as drinking water requirement for Hubli-Dharwad twin city, but, in the

revised DPR of Malaprabha Reservoir Project [Volume 33(B)], it is said that the provision for drinking and industrial purpose, when taken together, is only 0.216 tmc. In response to this, Shri Jamdar admitted that he had not examined the drinking water requirements of the twin city. To say the least, this is something which is shocking the conscience of the Tribunal.

(c)

In response to question No. 2, asked by the Tribunal, Shri Jamdar has admitted that the diversion of Kotni Dam water, was not intended for drinking water supply. The Tribunal finds that, Kotni Dam Project is basically for power generation and protective irrigation in the drought prone areas, as claimed by the State of Karnataka. A small, but very important question that arises here, is that, if the Kotni Dam is surplus in nature and not deficient, then why is the water not used for drinking water purpose in the drought prone area and is, instead being used, for the

purpose

of

power

generation

and

protective

irrigation, in complete disregard of National Water

Policy of 2012, which in no uncertain terms mandates

that drinking water is the first priority amongst all the priorities.

(d)

Further, the Tribunal finds that in response to question No. 2 itself, Shri Jamdar has stated that he has referred to the definition of “drought”, given in National Irrigation Commission, 1972, adopted by the Task Force, appointed by the Government of India, Ministry of Agriculture, under the Chairmanship of Dr. Hanumantha Rao, to examine the areas in the country, prone to drought and desertification. The Tribunal notices that the Irrigation Commission has defined an area as drought prone, if it fulfills three conditions viz. rainfall of less than 1000 mm; or less than 750 mm over a period of 20% or more of the given time series; and lastly less than 30% irrigated area. Using this definition, the Irrigation Commission has identified 12 districts in the country as drought prone and some Taluks thereunder. Under this

classification,

the former Bijapur District, which is

now bifurcated into Bagalkot and Bijapur District, was

included and Badami Taluk, which is now in Bagalkot

District was defined as a drought prone. This District

and Taluk, are the part of the Malaprabha command area. The Tribunal finds that in the light of above mentioned answers, it is evident that the State of Karnataka
was aware of the Malaprabha being a
drought prone area ever since the year 1972 and yet, it has implemented faulty planning and allowed water guzzling crops such as sugarcane to be cultivated, which definitely worsens the situation. It is, thus very clear that the so called drought situation in the Malaprabha Basin is the creation of entirely faulty planning and mismanagement of the whole situation by the State of Karnataka .

(e)

The evidence tendered by Shri Jamdar, on behalf of the State of Karnataka , on the basis of his Affidavit-in-Evidence (Volume 206), dated 14.11.2017 and his answers in the cross-examination are ridden with inconsistencies and create a lot of doubt in Tribunal’s

mind. This is because the picture projected by the witness in its cross-examination, is not at all in consonance with the claims and averments made by the State of Karnataka in its pleadings. The Tribunal firmly finds that Shri Jamdar, as a witness for the State

1093

of Karnataka, has failed to establish the case of the State of Karnataka, and has rather contradicted and to a certain extent, disproved the case of State of Karnataka

558.

Thus, the Tribunal finds that the evidence given by Shri Jamdar, witness for the State of Karnataka , cannot be relied upon at all.

Evaluation of oral evidence of RW-4 Shri G.M. Madegowdafor the State of Karnataka

559.

Shri G.M. Madegowda (RW-4), witness for the State of Karnataka has deposed before the Tribunal on behalf of the State of Karnataka. His testimony shows that he had, inter alia, occupied the post of Chief Engineer, in the Karnataka Urban Water Supply & Drainage Board at Bangaluru and Mysuru in Karnataka from April 2016 to December 2016. His testimony further shows that he was working with the Karnataka Urban Water Supply & Drainage Board since the year 1983 and has

retired since. In his Affidavit-in-Evidence dated 10.11.2017, Shri Madegowda has stated that the Water Resources Department of the State of Karnataka had requested him to depose before the

1094

Tribunal as an Expert Witness on the “Report on the Drinking Water Demand of Hubli-Dharwad and en route Villages, etc. from Malaprabha Reservoir” and Water Supply Requirements.

560.

Shri G.M. Madegowda filed his Affidavit-in-Evidence dated 10.11.2017 before the Tribunal. He has prepared a “Report on the Drinking Water Demand of Hubli-Dharwad, and en route Villages etc. from the Malapra bha Reservoir”. He states that the said Report was prepared under his authority as the Chief Engineer, North Zone, Dharwad. In conclusion to the said Report, Shri Madegowda has submitted that Hubli-Dharwad and en route villages and towns etc., require about 7.56 tmc of water by the end of 2044 AD.

561.

Along with his affidavit dated 09.11.2017, Shri Madegowda has also relied upon, the following documents:-

(a)

Annexure-1 to the Affidavit:- Report of Energy Audit conducted and reported by Tata Energy

Research Institute (TERI), 2002, under Municipal Energy Efficiency Outreach Program, Hubli-Dharwad.

1095

(b)

Annexure-2 to the Affidavit:- Report from Karnataka Urban Water and Sanitation Sector Improvement Project of May, 2003.

(c)

Annexure-3 to the Affidavit:- List prepared by Chief Engineer, K.U.W.S.&D. Board showing various measures undertaken for improvements to bulk water supply and distribution of Hubli-Dharwad etc.

(d)

Annexure-5 to the Affidavit:- Communication dated 12.08.2015 written by the Chief Engineer (North), Karnataka Urban Water Supply & Drainage Board to the Commissioner of Police, Hubli-Dharwad Twin city, Navanagar, Hubballi.

(e)

Annexure-6 to the Affidavit:- Chart, prepared by Chief Engineer, K.U.W.S.&D. Board, Dharwad,

indicating

the

Population

Projection

by

Geometric Projection method.

562.

This

witness

was

cross-examined

by

Shri

DattaprasadLawande, the learned Advocate General for the State

of Goa, with regard to, inter alia, his Affidavit and the documents

relied upon by him. Certain questions were also put by the Tribunal to the witness to elicit the best information.

563.

As noticed earlier, Shri Madegowda has submitted that Hubli-Dharwad and en route villages and towns etc. require about 7.56 tmc of water by the end of 2044 AD. This statement made by the witness completely destroys the case put forth by the State of Karnataka at Para 5(i)(e) on page 8 of the letter of complaints dated 22.06.2010 that the need for 7.56 tmc to meet the urgent necessity of drinking water and also claimed as urgent and imminent in the interim application, which was filed for seeking permission of the Tribunal to divert 7 tmc of water from Mahadayi Basin to Malaprabha Basin.

564.

The inconsistencies, which are apparent from the answers given in cross-examination by Shri Madegowda, are identified by the Tribunal and they are as under:

(a)

The State of Goa questioned Shri Madegowda

regarding using the Neerasagar Reservoir as a source of water and tried to know from him as to whether the storage capacity for the said Reservoir was over

estimated by the State of Karnataka. Shri Madegowda did not deny the suggestion included in the question to the effect that the storage capacity for using the NeerasagarReservoir as a source of water was over estimated by the State of Karnataka, and, instead gave a very evasive answer, which the Tribunal thinks, did not provide, a sufficient explanation relating to the subject matter of the question asked, at all. In fact, the Tribunal expected that the witness must be knowing, the basic fact mentioned in the question, namely the storage capacity, for using the Neerasagar Reservoir, as a source of water, was over estimated by the State of Karnataka, because since April, 2016, he was discharging duties as Chief Engineer, North Zone, which also includes Hubli-Dharwad twin city.

(b)

Shri Madegowda was then questioned about the mismanagement of water in the Hubli-Dhawad area, of which he was the Chief Engineer. The same has

been highlighted in the Final Report dated May 2003, titled as “Karnataka Urban Water and Sanitation Sector Improvement Project Demonstration Projects

and Priority Investments", which is Annexure -2 to his Affidavit-in-Evidence (Volume 207). The Tribunal notices that in this Report, it is mentioned that, alleged shortage of water is not on account of non-availability of water in the twin city but is in fact due to complete mismanagement of available water resources by the Karnataka Urban Water Supply and Drainage Board. A further scrutiny made by the Tribunal, of the said Report, invariably shows that the actual consumption of water in Hubli-Dhawad twin city, has no proper system of metering of any type and thus no records exist pertaining to the domestic consumption of water in the said region. Again, the Tribunal finds that despite occupying the post of Chief Engineer (Hubli-Dhawad), Shri Madegowda could not give satisfactory explanation relating

to

mismanagement of water in Hubli-Dhawad city.

(c)

What is important to notice is that, in the above mentioned report, it is mentioned that, the water pipe lines in the said region are not maintained properly, which has resulted into several instances

of

breakdown and leakages on account of the pipe bursting. The Tribunal finds that this is a complete waste of water, which is very important and scarce from view point of the principles and guidelines enunciated in National Water Policy, 2012 and that too in a drought prone area. In reply to question No. 9, put to the witness by the Tribunal, the witness has mentioned that, the joints of the pipes are leaking because the pipes are incrusted, corroded. It has come on the record of the case, pumps utilized to drain the water are broken and, as such, not working properly, at all. The Tribunal is of the firm opinion that, this unequivocally, demonstrates that, the State of Karnataka has totally failed to take care and use the water resources efficiently, which are scarce in nature. Such wastage of water, due to faulty water management can hardly justify the claim of State of Karnataka that it is in need of diversion of 7.56 tmc of waters from Mahadayi Basin for meeting the drinking

water needs of Hubli-Dharwad twin city.

1100

(d)

In his evidence, Shri Madegowda has stated that, the drinking water needs for the Hubli-Dharwad area, is 7.56 tmc for the year 2044 AD. However, in Question No. 3, Shri Madegowda was confronted with the letter dated 30.03.2002, addressed by the Secretary, Water Resources Department, Government of Karnataka to the Secretary, Ministry of Water Resources, Government of India, wherein it was stated that there was, an imminent need of 7.56 tmc of water, to meet the needs of Hubli-Dharwad area. In response to this question, Shri Madegowda clearly admitted that, there is no imminent need of 7.56 tmc for drinking water requirements and that this is the need for the

year 2046 AD. Thus, the Tribunal finds that the State of Karnataka is in the habit of blowing its case, out of proportion and has claimed diversion of 7.56 tmc of water as an imminent and urgent need, without any factual basis.

(e)

In question No. 4, the State of Goa had confronted Shri Madegowda with regard to the sudden jump in the population of the Hubli-Dharwad area since the

population, from 1981 till 2011(30 years), has increased, by only about 4 lakhs, whereas from 2011 to 2051, the increase in population, projected is of about 18 lakhs. On reading the testimony of this witness, it becomes evident that Shri Madegowda was unable to provide the Tribunal with a reasonable explanation as to how the sudden jump in population of Hubli-Dharwad is estimated. Therefore, the Tribunal is of the firm opinion that the projection of increase of the population in the Hubli-Dharwad area, is highly inflated, just to increase and justify the demand of water made by the State of Karnataka without any actual basis for such estimation, which is erroneous and cannot be accepted by the Tribunal.

(f)

The witness Shri Madegowda, in his evidence, has also mentioned that, round the clock police protection is required for the water supply infrastructure for Hubli and Dharwad and, according to him this is, because

the farmers are agitating as they want to grow various crops and that their livelihood is affected. From this answer, it becomes absolutely clear that what is being

projected as a shortage of water for drinking purposes, is in fact, need for irrigation and there is a tussle for water between the powerful farmers on one hand and the hapless city residents on the other.

565.

In the light of the above discussion, the Tribunal finds that the evidence given by Shri Madegowda, on behalf of the State of Karnataka , on the basis of his Affidavit-in-Evidence (Volume 207), dated 09.11.2017, clearly establishes, the mismanagement of the scarce water resources, by the State of Karnataka. Shri Madegowda has been unable to demonstrate that due care is being taken for proper management and utilization of, already available water resources. According to the Tribunal, it is more than clear that the water shortage in Karnataka is man-made and would not exist if the available water resources are properly managed and utilized. The Tribunal also finds that projection of population of Hubli-Dharwad twin city is on very very high side and is not based on any scientific principles which are being adopted while carrying out census of the

country, by agencies of Central Government. The Tribunal finds that the testimony of Shri Madegowda fails to prove, the case of the State of Karnataka

and

rather, he has, to an extent,

1103

disproved the case of the State of Karnataka. Therefore, the Tribunal does not think it prudent, to place reliance on the testimony of Shri G.M. Madegowda, which is full of inconsistencies, as pointed out earlier.

Evaluation of oral evidence of MW-2 Shri B.C. Kunjirfor the State of Maharashtra

566.

The Tribunal finds that Shri B.C. Kunjir, MW-2, witness for the State of Maharashtra, has deposed, before the Tribunal, with respect to the topic, “Water Need s of Maharashtra in Mahadayi Basin”. From his testimony, it is evident that he had worked as Chief Engineer, Konkan Region and had also officiated as

Executive

Director,

Konkan

Irrigation

Development

Corporation between October 2013 and May 2015. He had also

served as a Chairman and a Member of few committees, constituted by the Government of Maharashtra, to look into specific issues, in Water Resources Development and Management. From the details made available by the witness to the Tribunal, it is evident that he was appointed by the Government of Maharashtra, vide G.R. dated 1st August, 2017, as an Expert Witness on behalf of the State of Maharashtra and to

depose before the Tribunal about the “Water Need s of Maharashtra in Mahday i Basin’.

567.

Shri B.C. Kunjir has filed his Affidavit of Examination-in-Chief, dated 27.10.2017, before the Tribunal on 14.11.2017. From the said Affidavit, it is evident that, he has conducted a study regarding expected population of Hubli-Dharwad twin city in 2051 and domestic, irrigation, evaporation losses and industrial needs of Maharashtra. The said study is annexed by him as “A Study in respect of Water Needs of Maharashtra in Mahadayi Basin.”

568.

Along with his Affidavit dated 27.10.2017, Shri Kunjir has also relied upon and produced, the following documents:-

(a)

Relevant page of the Report of Maharashtra Water & Irrigation Commission, Government of Maharashtra of June, 1999, volume I, APPROACH, marked as MARK-MAH/6.

1105

(b)

Study conducted by him in respect of Water Needs of Maharashtra in Mahadayi Basin dated 27.09.2017 and produced as EXH. MAH/MW2/1.

(c)

The relevant page of the Report of Maharashtra Water & Irrigation Commission, Government of Maharashtra of June, 1999, Volume I, APPROACH, marked as MARK-MAH/7(Colly.).

(d)

A copy of the Report dated 06.10.2017 prepared by him in respect of visit by him, of Maharashtra Basin on 2 nd and 3 rd October, 2017, which is marked as EXH. MAH/MW2/2.

569.

The witness was cross-examined on behalf of the State of Goa, by Shri DattaprasadLawande, the learned Advocate General for the State of Goa, in respect of the matters mentioned in his affidavit and the documents relied upon and produced by

him. Some few questions were also put to the witness, by the Tribunal, to elicit better information.

1106

570.

On the perusal of the aforementioned cross-examination, the Tribunal finds that the witness Shri Kunjir, has been unable to really prove and substantiate the case put forth by the State of Maharashtra. The Tribunal notices that, the witness has not been able to demonstrate and prove completely and fully, the specific claims and the averments made by the State of Maharashtra in its pleadings. The Tribunal proposes to list them hereunder:-

(a)

The State of Maharashtra and its witnesses claim compensation, from the share of water of Tillari basin, given to the State of Goa, under the Agreement, by way of diversion of water, from Mahadayi Basin. However, the Tribunal notices that, when asked about the same, by the State of Goa in question Nos. 1 & 2, Shri Kunjir, in answer has stated that, the Tillari Agreement does not contemplate any such clause relating to the fact that the State of Maharashtra

should be compensated by way of diversion of water from Mahadayi Basin. The Tribunal finds that the answers given by the witness to the above mentioned questions prove that there is no legal or substantial

basis for the claim of compensation advanced by the State of Maharashtra.

(b)

Shri Kunjir, not only in his Affidavit-in-Evidence dated 27.10.2017, but also in answer to Question No. 4, asked by the State of Goa, has explicitly stated that Tillari basin is not a deficit basin but is rather a surplus basin and is abundant in waters. Thus, the testimony of this witness establishes that there is no shortage of water in Tillari basin and, therefore, diversion of water sought for, by the State of Maharashtra, from Mahadayi Basin, has no legs to stand.

(c)

In question No. 7, a suggestion was put to Shri Kunjir, by the State of Goa, that, in his study, he has over-exaggerated the domestic requirements, arrived at by him in paragraph 4 of his Report, wherein, he has estimated,

requirements

according

to

urban

requirements, which are completely unrealistic to the rural villages, for which the same is actually calculated. The Tribunal notices that Shri Kunjir was unable to justify, his calculations of requirements of

water. Shri Kunjir stated that he had taken into account the transition of a rural society, into an urban one, but the Tribunal is of the opinion that, this response, is completely unrequited and defeats the purpose of any differentiation between urban and rural areas. The Tribunal, thus, finds that the domestic requirements have been over-exaggerated by the witness Shri Kunjir, as suggested by the State of Goa and estimates of water requirements made by him, cannot be accepted by the Tribunal.

(d)

The Tribunal further notices that in Question No. 4, which was posed by the State of Goa to the witness, as to whether the witness has referred to or relied upon any water balance study, with respect to the availability of total water, in Tillari basin, vis-à-vis, the needs and requirements of Tillari basin, the Tribunal notices that Shri Kunjir, candidly said no and further stated that his study and Report are restricted to

Mahadayi Basin only.

1109

(e)

The Tribunal further finds that even with regard to observations made by Shri Kunjir, on siltation and sedimentation in the estuaries, in study, he has admitted that those observations are not based on any scientific study and/ or report. The same fact is admitted by him, in answers to Questions Nos. 3 & 4, posed to him, by the Tribunal. The Tribunal is of the opinion that response of this sort by an expert witness would lead the Tribunal to conclude that the witness has really not taken the data and analyzed it separately, but has merely relied upon and reproduced what is stated in the CWC (2003) Report.

571.

In fact, the Tribunal expected from Shri Kunjir that, as an expert, he would conduct a thorough and independent study with regard to the water demand, based on principles recognized. The Tribunal finds, absence of such concentration and precision in the report, submitted by Shri Kunjir and, therefore, the Tribunal is of the opinion that it is difficult for the Tribunal to rely upon the statements made by him, which are quite unknown to the basic principles of assessment of water demand and water resources planning.

1110

572.

Under the circumstances, the testimony of Shri B.C. Kunjir, MW-2, is not found to be acceptable by the Tribunal and the Tribunal is of the firm opinion that the same cannot be acted upon.

DECISION AND FINDINGS BY THE TRIBUNAL ON IMPORTANT QUESTIONS

Prejudice

573.

One of the foremost, almost a preliminary, submission has been raised by Shri Mohan V. Katarki, learned Counsel appearing for the State of Karnataka, and later on, during the course of arguments has been even reiterated by Shri Shyam Divan, the learned Senior Counsel, appearing for Karnataka, that under section 3 of the Act, one of the basic requirements for adjudication of a water dispute is that complainant party must plead and disclose that it is being “affected prejudicially.” It has been asserted that the aforesaid requirement is the basic requirement for affording a cause of action to the complainant

party, and in the absence of the pleadings to that effect the

complaint filed by the complainant State cannot be entertained. On that basis, it has been maintained that the complaint filed by the State of Goa, and even the Statement of Claims filed on the basis of the aforesaid complaint, lack the aforesaid ingredient and as such is not legally maintainable.

574.

The aforesaid contention raised on behalf of the State of Karnataka has been vehemently contested by the State of Goa through its Senior Counsel Shri Atmaram N.S. Nadkarni.

575.

It has been pointed out by the learned Senior Counsel that the complaint contains all the relevant facts, as are required to be stated in the complaint under section 3 of the Act, and even the Statement of Claims filed by Goa contains all the necessary pleadings, disclosing all the material facts, which indicate an injury to the State of Goa, and also show that its interests have been prejudicially affected.

576.

Before noticing the details of the pleadings of the

parties, in this regard, it would be absolutely necessary to notice the relevant provisions of the Inter-State River Water Dispute Act, 1956 (Act).

1112

The preamble of the Act reads as under:

“An Act to provide for the adjudication of
disputes relating to waters of inter-State rivers
and river valleys.”

Some of the relevant provisions of the Act are as follows:

Section 2(c) “water dispute” means any
dispute or difference between two or more
State Governments with respect to –

(i)
the use, distribution or control of
the waters of, or in, any inter-State
river or river valley; or
the interpretation of the terms of
any agreement relating to the use,
distribution or control of such
waters or the implementation of
such agreement; or

(ii)

(iii) the levy of any water rate in

contravention of the prohibition

contained in section 7”

Section 3: “If it appears to the Government of any State that a water dispute with the Government of another State has arisen or is likely to arise by reason of the fact that the interests of the State, or of any of the inhabitants thereof, in the waters of an inter-State

river or river valley have been, or are likely to be, affected prejudicially by-

(a)

Any executive action or legislation taken or passed, or proposed to be taken or passed, by the other State;

or

The failure of the other State or anyauthority therein to exercise any of their powers with respect to the use, distribution or control of such waters; or

The failure of the other State to implement the terms of any agreement relating to the use, distribution or control of such waters; the State Government may, in such form and manner as may be prescribed, request the Central

Government to refer the water dispute to a Tribunal for adjudication."

(b)

(c)

Section 4(1): "When any request under section 3 is received from any State Government in respect of any water dispute and the Central Government is of opinion that the water dispute cannot be settled by negotiations, the Central Government shall, within a period not exceeding one year from the date of receipt of such request, by notification in the Official

Gazette, constitute a Water Disputes Tribunal for the adjudication of the water dispute.

Provided that any dispute settled by a Tribunal before the commencement of Inter-State Water Disputes (Amendment) Act, 2002 shall not be re- opened."

Section 5(1): "When a Tribunal has been constituted under section 4, the Central Government shall, subject to the prohibition contained in section 8, refer the water dispute and any matter appearing to be connected with, or relevant to, the water dispute to the Tribunal for adjudication.

(2) The Tribunal shall investigate the matters referred to it and forward to the Central Government a report setting out the facts as found by it and giving its decision on the matters referred to it within a period of three years:

Provided that if the decision cannot be given for unavoidable reasons, within a period of three years, the Central Government may extend the period for a

further period not exceeding two years. ”

577.

As noted above, “water dispute” has been defined as any dispute or difference between two or more State Governments with respect to the use, distribution or control of the waters of, or in, any inter-State river or river valley. In any such case, when the Government of State realises that there is

any dispute or differences between it and some other States with regard to any inter-State river or river valley, it would make a request to the Central Government detailing out the aforesaid facts and the nature of dispute or differences between two or more States. On receipt of such letter of request, the Central Government is required to make an attempt to settle the aforesaid dispute by negotiations and if even after making the aforesaid attempt, the dispute cannot be resolved, the Central Government shall constitute a Water Disputes Tribunal for adjudication of the water dispute.

578.

Section 3 of the Act provides that a letter of request can be made by a State Government to the Central Government for constitution of Water Disputes Tribunal, only in a case when it appears to the said State Government that a water dispute has arisen or is likely to arise, on account of which the interest of the said State in the water of an inter-State river or river valley have been or are likely to be affected prejudicially. Apparently, section 3 is in two paras. The first part deals with a situation when the

Government of any State feels that a water dispute with another State Government has arisen. The second part of the section deals with a situation when it appears to the Government of a

State that a water dispute with another State Government is likely to arise. Thus, the provision deals with not only the disputes in *presenti* ,which exist on a date when the letter of request is sought to be addressed by the State Government, but also deals with such future disputes which are likely to arise between two or more States. In anticipation of any water dispute, the State Government would be well within its rights to address a letter of request to the Central Government. However, a common factor in both the situations is that such a water dispute has or is likely to affect prejudicially the interests of the complainant State. The definition of water dispute under section 2 (c) is very broad, in as much as, it provides that any dispute or difference between two or more State Governments with respect to the use, distribution or control of the waters of, or in any inter-State river or river valley would constitute a water dispute. The definition includes certain other situations also, which are not relevant for the present controversy. Further, section 3 entitles a State Government to address a letter of request to the Central Government, when “it appears to the Government of any State”.

Thus, it is the satisfaction of the complainant State Government, that any water dispute has arisen or is likely to arise, with another State Government, with regard to an inter-State river

water or river valley, which has, or is likely affect prejudicially the interests of the complainant State Government or its inhabitants, that the letter of request can be addressed by it to the Central Government. Apparently, there are no riders on the discretion of the complainant State Government to come to its satisfaction that the requirement of section 3 have been duly met before it addresses a letter of request to the Central Government. The satisfaction of the State Government, with regard to the existence of the water dispute or likely thereof, affecting prejudicially, the interests of the State Government or its inhabitants cannot be questioned by the opposite State Government.

579.

Thereafter, after the process of negotiations has been gone into by the Central Government to settle the aforesaid water dispute between the two State Governments through negotiations and in a situation when the aforesaid negotiations have failed, the Central Government is required in law to constitute a Water Disputes Tribunal. When such a Tribunal has

been constituted by the Central Government, a reference of the water dispute shall be made to the Tribunal for adjudication and the Tribunal has been given the powers to investigate the matter

referred to it, and forward to the Central Government the report of its findings and its decision.

580.

The language of section 5 of the Act, reproduced above, clearly indicates that it is not the letter of request addressed by the State Government to the Central Government, which is referred for adjudication to the Tribunal so constituted, but it is the water dispute and any matter appearing to be connected with, or relevant to the water dispute, which shall be referred to the Tribunal by the Central Government for adjudication. The Tribunal has also been granted the power to investigate the aforesaid water dispute, and even the connected matters thereto, and thereafter adjudicate the same and forward its report to the Central Government.

581.

In view of the aforesaid legal provisions, it would be pertinent to notice that the State Government of Goa has protested against the proposed projects of the State of Karnataka, inter alia, on the ground that any diversion of the

waters from river Mahadayi, by Karnataka outside Mahadayi basin, will adversely impact environment, navigational flow, ecology, fisheries and wildlife in the State of Goa. Some of the

relevant paragraphs of amended Statement of Claims of Goa, (Volume 131), may be extracted as below:

“190C(xix). Without prejudice to the aforesaid, the State of Goa respectfully states that any activity of diversion of water of Mhadei River of whatsoever nature including for a dam would drastically affect the wildlife in the Mhadei Wildlife Sanctuary. Any reduction in the flow of water in Kalsa River (Surla River) would damage the delicate eco-system and consequently, completely damage the biodiversity. As stated above, Surla River is responsible for maintaining the macroclimate which ultimately serves diverse flora and fauna. If the inflow of water is reduced, the whole Wildlife Sanctuary project would be lost causing degradation in ecology. Any disturbance in the fragile ecology of this valley will have adverse affect on vegetation on hill slopes and displace the wildlife population. Any migration of wildlife would give rise to the conflict between the man and animals. The same

would result in social chaos. The social economic life of the local community living around the Sanctuary, both in the State of Karnataka and the State of Goa would be completely jeopardized. ”

“ 190C(xx). The Stat e of Goa states that the proposed diversion of water by the State of Karnataka and State of Maharashtra would increase the salinity of water, there will be increase in the tidal base water flow. The residents living on the banks of Surla River, i.e. Villages of Surla, Derodem, Codal, Vainguinim within the

villages of Nanoda and Uste, besides the Sanctuary, would suffer immensely on account of depletion of River water. In addition, the source of underground water would also be completely depleted. There is every possibility that the increase of salinity levels in the river would consequently affect ground water of these Villages which would also go high in saline content. For all these reasons, the abstraction of water in Mhadei in this regard is not at all justified, or permitted. ”

“190C (xxvii). The State of Goa states that the Doctrine of Public trust and Precautionary Principle, by no standard of imaginations, the State of Karnataka and State of Maharashtra can be permitted to carry on their construction and divert the water from Mhadei River into any other basin or for that matter, to divert any water from Mhadei River. The same would have devastating effect on the ecology, sociology and the economy of the people and the State of Goa. Any such Projects or

intentions on the State of Karnataka and State of Maharashtra cannot be allowed or permitted at the cost of the ecology. ”

582.

Besides the above pleas, the State of Goa has also pleaded that the aforesaid diversion of water of Mahadayi River by the State of Karnataka would have disastrous consequences on the natural flow of the water and would adversely affect the navigation channels in the State and that, it would also cause loss

of water resources for cheap and environmentally clean hydro-power potential within the State of Goa. A plea has also been raised with regard to adverse consequence on the natural flow of water to the biological hotspot in the Western Ghat, Wildlife Sanctuaries and other precious species.

583.

However, at this stage, it would not be necessary to go into detail of all the facts pleaded by Goa with regard to adverse consequences of the diversion of water, proposed to be undertaken by Karnataka. However, it would be appropriate to notice that all the aforesaid pleas raised by Goa have been vehemently controverted and denied by the State of Karnataka. For the determination of the present issue, it will be wholly unnecessary to notice the aforesaid pleas of Karnataka, inasmuch as, at this stage merely it has to be determined as to whether the pleadings and averments of the State of Goa are covered by the provisions of sections 2 and 3 of the Act or not.

584.

It would also be pertinent to refer to a portion of the

cross-examination of Shri A.K. Bajaj, RW-2, an expert witness, produced by the State of Karnataka. Question No. 7 was asked to the said witness as to whether some transboundry impact was

likely to be experienced by the State of Maharashtra and Goa, pursuant to the project intended by the State of Karnataka , the witness replied as follows:

“Ans. Yes, I agree that there will be some impact on the downstream States due to the projects being taken up by the upstream State. However, the question is the quantum of such impact. I have also seen the location of the project which Government of Goa is proposing from their pleadings before this Hon’ble Tribunal. The Government of Karnataka has indicated, in their pleading before this Hon’ble Tribunal, that diversion from Mahadayi, more particularly, the Bhandura, Haltara/Kalasa, and Kotni/Bailnadi/Irti Projects will be during the monsoon only. The diversion from the other projects to Kali basin are very small quantity of 0.604 TMC, 1.102 TMC and 2.613 TMC, respectively, which may or may not be taken during the monsoon only. Thus, as per the State Government of Karnataka, the withdrawal by the

Government of Karnataka be only during the monsoon months, when there is plenty of water in the river, the small quantity being withdrawn will not have any major effect. The answers to the further questions are as follows: -

(a)

Yes, there will be limited impact of reduced flow immediately downstream of the point from where the water is proposed to be withdrawn in any stream, but there will be regeneration

of water in the stream from within the stream itself and the tributaries joining the stream thereof.

(b)

The eight projects of Karnataka referred in the question are by no stretch of imagination massive projects. As per the standard classification of projects of the Government of India, they would be categorized as minor projects. As I have clarified, the impact is only on the immediate downstream and that also during the non-monsoon period, when flows are low. The working of the Ganjim weir seen by me is that no water is detained at the weir in the monsoon period as the gates are kept open and there will be no impact on the Ganjim weir of the withdrawal bythe

Government of Karnataka. As I am not aware of the location of the Opa drinking water project, I will not be able to comment on the effect of the Karnataka projects on this project of Goa.

As brought out in my Report, out of the 63 projects proposed by the State of Goa, only 8 projects, as indicated on page 17 of my Report, will be somewhat affected.

As already replied, in my answer to question 7 and sub-question (a) of the

(c)

(d)

present question, there will be a minor impact of the diversion by Government of Karnataka and no severe impact can be envisaged.

(e)

Many efforts have been made to define e-flows, but still there is no consensus and no values have been fixed for the same. I am not an environmental engineering expert and will not be able to say what impact there will be on the six wildlife sanctuaries in the Mahadayi basin. That can only be ascertained by carrying out an Environment Impact Assessment study."

585.

It is thus clear from the pleadings of Goa contained in its Statement of Claims, and the statement of RW-2 Shri A.K. Bajaj, that the State of Goa has clearly brought such material on

the record, which would indicate that it has appropriately shown that Goa would be “prejudicially affected” by the diversion of water by the State of Karnataka from Mahadayi river to outside Mahadayi basin in the State of Karnataka.

586. It would also be pertinent to notice the history/background of the dispute, as it emerges out of the respective pleadings of the parties.

1125

587.

It appears that plan for utilization of the water of the inter-State river Mahadayi in Karnataka started in the year 1980. A protest was raised by Goa. Number of inter-State meetings were held between the State Governments of Goa and Karnataka. However, the party States did not reach any agreed conclusion. On 16.4.2002, the State of Karnataka wrote a communication to Ministry of Water Resources, Government of India, seeking an ‘in principle clearance’ for diversion of 7.56 tmc of water from Mahadayi basin, claiming to be for drinking water needs of Hubli-Dharwad cities. The Central Government appears to have given the ‘in principle’ clearance on 30.04.2002 to Karnataka. An objection was taken by the State of Goa in the matter and intervention of the Prime Minister was requested. Apprehended that the State of Karnataka may proceed with the project, a request letter dated 9.7.2002 was filed by Goa to the Central Government for setting up a Water Disputes Tribunal under section 3 of the Act. According to Goa, on account of

various objections taken by it, the Ministry of Water Resources of Government of India, on 19.02.2002, placed the aforesaid ‘in principle’ clearance accorded to the State of Karnataka in abeyance. Goa has maintained that because of the fact that the

1126

Central Government did not constitute a Water Disputes Tribunal, it approached the Supreme Court of India by filing an original suit on 15.09.2006. An injunction was sought against the State of Karnataka

not to proceed with any planning,

construction and water resolution of any project in the Mahadayi river basin, and till all the inter-State disputes were adjudicated and decided by the Tribunal. The aforesaid civil suit was contested by the State of Karnataka, by filing a counter affidavit. The various pleas taken by the State of Goa were denied.

588.

Proceedings continued before the Supreme Court till

the year 2010, when the Central Government, in exercise of its powers under section 4 of the Act, issued a notification dated 16.11.2010, constituting the MWDT for adjudication of water disputes relating to the inter-State Mahadayi river valley. Subsequently, on 11.1.2011, a reference was made to the Mahadayi Water Disputes Tribunal for adjudication of inter-State river dispute concerning the States of Goa, Karnataka and

Maharashtra, regarding inter-State river Mahadayi and the river valley, thereof. Consequently, the aforesaid original suit was disposed of and it was observed by the Supreme Court that all

1127

the issues raised in the suit were to be raised before the Tribunal for adjudication and decision.

589.

In view of the aforesaid background, it is evident that the parties have been at a constant and contentious dispute with regard to the aforesaid water dispute between them.

590.

In the aforesaid background of the matter, it would be advantageous to notice certain observations made by the Apex Court in the case of the State of Karnataka by its Chief Secretary Vs. the State of Tamilnadu by its Chief Secretary and Ors. (2018) 4 Supreme Court Cases 1, as follows:

“159. Relying on the said provision, it is urged by Mr. Nariman that there is no assertion with regard to either the State of Tamil Nadu or its inhabitants being prejudicially affected in any other manner except the agreement and, then, the conditions precedent as postulated in clauses (a), (b) and (c) of Section 3 are not met with. He has referred to

issues 8, 10, 40 and 43 by the Tribunal on prejudicial affectation and stated that the Tribunal has not recorded any finding that the State of Tamil Nadu has been prejudicially affected within the sphere of Section 3. On the contrary, it has held that the issue regarding prescriptive right of Madras has become academic and the injury caused to each State at one

stage or the other by the conduct of the other State has become a matter of history and it is not easy to assess any injury in an irrigation dispute. Learned senior counsel would further submit that the State of Tamil Nadu did not plead for a claim to any right which is conferred on it by the two agreement either in its complaint or on the statement of case before the Tribunal. The complaint deserves to be dismissed in the absence of proven injury. Mr. Naphade and Mr. Dwivedi, learned senior counsel being assisted by Mr. G. Umapathy, learned counsel, in their turn, would contend with vehemence that such a contention at this stage is absolutely specious and should not engage the attention of this Court even for a moment. They would submit that the series of meetings and the correspondence that had commenced in the beginning of the 70s of the last century would speak eloquently about the inhabitants being prejudicially

affected and further the various issues raised clearly exposit the grievances of the inhabitants of the State of Tamil Nadu. Additionally, it is contended by them that even if a finding is returned that the agreements have expired, rights had been created under the agreements and till they remain in force and also thereafter till the date of reference and more so when such a plea was not raised when reference was made to this Court under Article 143 of the Constitution, the said plea should be negatived.

160. The aforesaid submission advanced by the State of Karnataka should not detain us for long. On

a perusal of the complaint, it does not contain the words “prejudicially affected” but the antecedents of the complaint, the view of the Central Government while referring water dispute and the expression of opinion of this Court In Re: Presidential Reference (Cauvery Water Disputes Tribunal) (supra). In the backdrop of the language of the 1956 Act, the expiration by the efflux of time and the role of this Court, we are not inclined to entertain such a plea. We must say without any hesitation that it may, in the first blush, have the potentiality to invite the intellectual interaction but the same fails to gain significance when one perceives the controversy from a broader perspective and the various orders passed from time to time by the Tribunal and by this Court. Therefore, the matter deserves to be adjudicated on merits.”

591.

A similar objection raised by the State of Karnataka, that there was no assertion with regard to either the State of Tamil Nadu or its inhabitants being prejudicially affected in any other manner was not accepted by the Supreme Court, by observing that the antecedents of the complaints, the view of the Central Government while referring water dispute and the view taken by the Supreme Court In Re: Presidential Reference (Cauvery Water Disputes Tribunal) 1993 (Supp)(1) SCC 96.

1130

592.

The facts and background of the present controversy clearly indicate that in this case also, a very long standing dispute between the parties has remained pending and despite a long drawn process of negotiations for settlement of the same, the same has remained unresolved. Consequently, at this stage, the State of Karnataka cannot be heard to claim that the complaint of the State of Goa, dated 09.07.2002, does not contain the specific words “prejudicially affected”. Filing of application under Section 3 of the Act of 1956 will itself demonstrate and prima facie prove that the interests of the State or any of the inhabitants thereof of the State making the complaint, have been or likely to be affected prejudicially.

593.

Before parting with this aspect of the matter, it would be necessary to notice that at the initial stage of the arguments, the learned counsel for the State of Karnataka took up a specific objection that though the requirement of “affected prejudicially” under section 3 of the Act is the basis of the cause of action and

there is no express averment in the complaint of the State of Goa that “interests” of the State of Goa or its inhabitants “have been or are likely to be, affected prejudicially”, by the acts and omissions of the State of Karnataka. The arguments were

addressed on the basis of the aforesaid objection, which was taken almost as a preliminary objection. The aforesaid objection was forcefully met by the learned senior counsel for the State of Goa, by taking up the legal pleas, as well as by drawing our attention to the factual aspects of the matter and pleadings of Goa. However, later on, during the course of the continued arguments, the State of Karnataka appears to have shifted its stand that the evidence on the record indicated that since the total available water in Mahadayi river was more than the quantum of water claimed by Goa and quantum of water claimed by the upstream State of Karnataka and Maharashtra, then the grievance of Goa that it is likely to be “affected prejudicially” would not survive for consideration.

594.

Suffice it to say that this Tribunal has elsewhere recorded findings of fact that the diversion of 7.56 tmc of water from Mahadayi River

to

Malaprabha

sub-basin

would

prejudicially affect environment, navigational flow, ecology, fisheries, wildlife, increase in the salinity of water, deletion of water flow in River Mahadayi, underground water of the villages Surla, Derodem etc., situated in the State of Goa. Thus, the question of prejudice, as raised by the State of Karnataka, has

become academic in nature and no longer survives. However, at this stage, while determining the maintainability of the complaint filed by the State of Goa, as well as the statements of claims filed by the State of Goa, it is not necessary to dwell into details about the above stated findings recorded by the Tribunal. The aforesaid aspects of the matter are dealt with by the Tribunal at the appropriate stage.

595.

Consequently, the preliminary objection raised by the State of Karnataka against the maintainability of the complaint, as well as the adjudicability of the statements of claim made by Goa, is devoid of merits and is, therefore, hereby rejected.

Effect of Deletion of Paras 28(Iv) and 28(V) from Goa's Complaint dated 09.07.2002

596.

It is mentioned in Statement of Claim filed by the State of Goa, that Karnataka is in a position to meet, Hubli-Dharwad water requirements, from locally available water resources and that there are other alternative sources available

to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli-Dharwad towns can be met as a higher priority than irrigation and hydro power needs in

those basins, whereas the State of Karnataka has mentioned that the State of Goa, is barred, in raising such pleas in view of deletion of para 28(iv) and 28(v) of its complaint dated 09.07.2002, vide its letter dated 10.01.2007, addressed to the Secretary, Union Ministry of Water Resources. In view of rival pleadings of the parties on this aspect of the matter, Issue 38 is framed by the Tribunal:

Issue No. 38:

"Whether the State of Karnataka establishes that the effect of unequivocal withdrawal of the contentions in para 28(iv) and 28(v) of its complaint dated 9.7.2002 vide letter dated 10.1.2007 addressed by the State of Goa to the Secretary, Union Ministry of Water Resources, New Delhi bars the State of Goa from objecting to drinking water needs to the twin cities of Hubli-Dharwad, including villages en route etc. (including Kundagol town) from Malaprabha Reservoir?"

597.

The State of Karnataka has vehemently maintained that the State of Goa had filed the original complaint under section 3 of the Inter-State Water Disputes Act, 1956, before the Government of India, for referring the water disputes between the two States viz. the State of Goa and the State of Karnataka to constitute a Water Disputes Tribunal. Later on, the State of Goa

had deleted paras 28(iv) and 28(v) from the aforesaid complaint in view of the letters dated 21.11.2006 and 04.01.2007 of the Government of India, Ministry of Water Resources. On that account, it is maintained by the State of Karnataka that after the deletion of the aforesaid two paragraphs, the State of Goa cannot raise any plea that Karnataka is able to meet, Hubli-Dharwad drinking needs from locally available water resources, nor the Tribunal should consider such a plea raised by the State of Goa.

598.

The aforesaid objection raised by the State of Karnataka has been strongly contested by the State of Goa. It has been maintained that the deletion of the aforesaid two paragraphs from the complaint of the State of Goa was without any prejudice to any other contents of the complaint of Goa, and further as per the clear understanding given by the Central Government through the Ministry of Water Resources, all the contentious issues with regard to the water dispute arising from Mahadayi river basin, river valley thereof, sharing of Mahadayi

river waters, its equitable distribution and extra basin diversion and other connected issues relevant thereto, are still required to be adjudicated by this Tribunal.

599.

For appreciation of the aforesaid controversy between the parties, it would be relevant to notice that the State of Goa had been raising a protest, and had also filed a complaint with the Central Government, with the grievance that the State of Karnataka had been making a constant and persistent attempt for outside basin diversion of the limited Mandovi river waters generated from the catchment area of Mahadayi river in its territory. It was mentioned in the complaint that the Mandovi is a short length river on the Western Coast of India, in a very fragile environment and there is existing navigation on the river for about 40 KMs of the river in the final reach and sufficient flow and draught (depth) is needed for the survival of the aforesaid navigation. It was also stated therein that, a very fragile balance exists between the sufficient water flow and the sea tidal ingress and salinity and the action being undertaken by the State of Karnataka for diverting the Mahadayi river water to Malaprabha basin would cause an irreparable loss and damage to the general population of the State of Goa, its navigational activities, its bio-

diversity and environment etc. With the aforesaid details, the State of Goa filed the above said complaint dated 09.07.2002 to

the Central Government. The following prayers were made in para 28:

“(i)

To adjudicate and decide correctly the available utilizable water resources of the Mandovi basin at 75% dependability at various points in the basin and at Karnataka's disputed project sites.

To adjudicate and decide the equitable shares of the three co-basin states in the above quantity of water taking into consideration the long term in basin needs of the three States for the beneficial uses of water (water supply, irrigation, hydro-power generation, navigation, pisci-culture and environmental protection, etc.)

(ii)

(iii) To adjudicate and decide whether in basin needs to be given priority over any contemplated extra basin diversions and whether there is any surplus left for extra basin diversions after adequately

providing for long term in basin needs.

(iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

(v)

To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher

priority than irrigation and hydropower needs in those basins.

(vi) To adjudicate and decide specific restraints or restrictions to be placed on the upstream riparian states with regard to construction and regulation of their project~ during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters.

(vii) To adjudicate and decide the machinery to implement the decision of the Tribunal."

600.

It is evident from the record, (Volume 38),that on 21.11.2006, the Government of India, through the Secretary of Ministry of Water Resources, responded to the State of Goa's complaint through the following communication:

"No. 5/4/2005 -BM

GOVERNMENT OF INDIA

MINISTRY OF WATER RESOURCES

Dated: 21.11.2006

To

The Secretary (WR),

Government of Goa,

Secretariat, Panaji,

GOA

1138

Subject:- Request for appointment of River Water-Disputes Tribunal under Section 3 of the Inter-State River Water Disputes Act, 1956 as amended.

Sir,

I am directed to refer to Govt. of Goa's letter No. 68-4/CE-WRD-EO-2002-03/208 dated 9.7.2002 on the above subject and to say that in accordance with the provisions of Section 4(1) of the Inter-State River Water Disputes (ISRWD) Act, 1956, the Ministry of Water Resources is of the opinion that water dispute contained in the aforesaid request cannot be settled by negotiation. Therefore, Central Govt. intends to take further action in the matter in accordance with the provisions of the said Act.

It is further stated that the aforesaid request has been examined by Central Government and it is found that the request at para 28(iv) & 28(v) contains references to basins other than Mahadayi

also. As per Section 3 of the ISRWD Act, 1956, the dispute/complaint in connection with a particular inter-state river or river valley can be referred to the tribunal and not for multiple basins. As such, the aforesaid request of the Govt. of Goa, in the present form cannot be referred to the Tribunal for adjudication of the dispute.

In view of the above, Government of Goa is requested to send a revised request to the Central

1139

Government containing references to Mahadayi basin only for taking further necessary action.

Yours faithfully,

Sd/-

(S. Manoharan)

Addl. Secretary (WR)"

601.

The Government of Goa replied to the aforesaid communication vide letter dated 13.12.2006, (Page 130 of Vol. 38). It was maintained that inclusion of the aforesaid paras 28(iv) and 28(v) is very important, because the diversion of water from Mandovi basin to water surplus Malaprabha basin is the main issue in this water dispute. Various facts, in support of the aforesaid stand of the State Government of Goa, were given. Consequently, it was maintained that there was no question of revising its request dated 09.01.2002.

602.

The record shows that on 04.01.2007, (Volume 38 page 135), the Government of India, Ministry of Water Resources

issued a letter to the Government of Goa with regard to reference of the water disputes to a Tribunal. The relevant portion of the aforesaid communication is as under:

“3. The arguments advanced by the Government of Goa in respect of para 28(iv) and 28(v) are based on merit consideration. However, the views of Central Government which were conveyed to the Government of Goa on para 28(iv) and 28(v) in November, 2006 are based on legal consideration. As such, the aforesaid request of Government of Goa, in the present form cannot be referred to the Tribunal for adjudication of the dispute.

4. Reference has been made in the letter of Govt. of Goa about referring the issue of possibility of augmentation of Krishna river by diversion of inter-state Godavari river and other inter-state river waters to the Krishna Water Dispute Tribunal (KWDT) by the Government of India. It is informed that KWDT has framed the following issues on this aspect:

“Whether on augmentation of water in river Krishna by diversion from any other river is entitled to contestant State to claim greater

share in augmented water? ”

A bare reading of the issue framed by KWDT and the issues included in the request of Government of Goa at para 28(iv) and 28(v) clearly indicate the vast difference between them. The issue framed by KWDT does not in any way entitle it to have jurisdiction over the other river basins. The issue framed by KWDT is basically to decide the share of the contestant State on diverted water, if any, from other basins.

1141

5. Thus, the issue before KWDT is basically the share of basin States in the diverted water. Whereas, the issues included in the request of Goa at para 28(iv) and 28(v) entitle the proposed new tribunal on Mahadayi to have jurisdiction over a portion of Krishna river basin and a portion of the other river basins, as the issues are basically to adjudicate and decide the matters contained in the above points of references, which will lead to the conflict over the jurisdiction with existing KWDT which is not permitted under the provisions of the ISRWD Act, 1956. The Act clearly bars Supreme Court or any other court (tribunal is a kind of Court) to have or exercise jurisdiction over a dispute which is referred to a tribunal under the provisions of the Act. In view of this, the request made by Govt. of Goa does not conform to the provisions of the ISRWD Act, 1956 on this count.

6. In view of the above, Government of Goa is again requested to send a revised request to the Central

Government containing references to Mahadayi basin only for taking further necessary action in this regard."

603.

It is further clear from the record that on 10.01.2007, the State Government of Goa accepted the revision of its complaint dated 09.07.2002 and agreed to delete the paras 28(iv) and 28(vi) from its complaint. The letter dated 10.01.2007 reads as under:

"No. CE/Mandov i Basin/2006-07/198

Office of the Chief Engineer (M.B.)

1142

Water Resources Department

GPD 1-3 & 1-4 D Type Quarters

Porvorim-Goa

Dated: 10/1/2007

To

The Secretary,

Ministry of Water Resources,

Government of India,

Shram Shakti Bhavan,

Rafi Marg,

New Delhi

Attention:

Shri S. Manoharan,Additional

Secretary(MOWR).

Sub: Request for appointment of Interstate

River Water Dispute Tribunal under

ISRWD Act, 1956

Ref: 1.

2.

3.

4.

This Office letter 68-4/CE-WRD-EO-

2002-03/208 dated 9/7/2003.

Your letter No. 5/4/2005-BM dated

21/11/2006.

This Office letter No. CE/Mandovi

Basin/2006/178 dated 13/12/2006

Your letter No. 5/4/2005-BM

dated 4/1/2007

Sir,

After due consideration your request vide letter dated 4/1/2007 by the Government of Goa, I am directed to inform you that the Goa's request for appointment of Tribunal under ISRWD 1956 may be

1143

processed by deleting the para 28(iv) & 28(v)
without prejudice to any other contents in the
Goa's request letter of 9/7/2002.

Yours faithfully,

Sd/-

(RaajivYaduvanshi)"

604.

Since the water dispute was between the State of Goa and the State of Karnataka and also the State of Maharashtra, therefore, it emerges that even the State of Karnataka had a grievance in the matter, and on 22.06.2010 filed its own complaint under section 3 of the Act, raising a water dispute against the State of Goa, and requested the Central Government "to constitute a Water Dispute Tribun al, and refer to the Tribunal so constituted for adjudication and decision, the water disputes and matters connected with, or relevant to the water disputes, (as well as interim measures), emerging from the letter of complaint and the Annexures hereto for adjudication and decision of water disputes and matters connected with or

relevant to the water disputes (as well as interim measures) emerging from this letter of complaint and the Annexures hereto.”

1144

605.

The relevant portion of the aforesaid complaint filed by the State of Karnataka are extracted hereunder:

“1.1 The Government of State of Karnataka is of the opinion that a Water Dispute has arisen by reason of the fact that the interest of the State of Karnataka and its inhabitants in the waters of the Inter-State Water river Mahadayi and its valley have been or are likely to be prejudicially affected by:

(a) The executive actions of the Government of the State of Goa resulting in denial of equitable share to the State of Karnataka in the available waters of the interstate river Mahadayi and its valley, which is not less than 45 tmc (consumptive use of 24.15 tmc).

(b) The executive actions of the Government of State of Goa in protesting against the attempting to prevent works undertaken for diversion of 7.56 tmc of water in the interstate

river Mahadayi by the Government of Karnataka under the Kalasa-Bhanduri project (a Drinking Water Project for inhabitants of Hubli-Dharwad and towns and villages en route)."

3.

SPECIFIC MATTERS IN DISPUTE:

(i) The following matters inter alia would arise for adjudication and consequent decision of the Tribunal:

1145

(a) Whether, the available water for allocation in the interstate river Mahadayi and its valley is not less than 220 tmc at 50% dependability?

(b) What is the available water at Haltar Dam, Kalasa Dam, Kotni Hydro-power Dam, Bail Nadi Dam site, Bhandura Dam site and entire catchment in Karnataka and Ganjim G & D site on main river, Khandepar at Colem G & D site and entire catchment up to mouth of the Sea of Goa in the interstate river Mahadayi and its valley?

(c) What is the contribution of water of each of the riparian States of Karnataka, Goa and Maharashtra to the available water of interstate river Mahadayi and its valley?

(d) On an equitable apportionment of the waters of the inter State river Mahadayi and its valley, whether, the equitable share of the riparian State of Karnataka is not less than 45

tmc annually (consumptive use of 24.15 tmc)?

(e) Whether the State of Karnataka is entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of waters every year of the interstate river Mahadayi to the Malaprabhariver in the Krishna basin?

(f) Whether, the inhabitants of twin city of Hubli-Dharwad, towns and villages have a right to

drinking water from the waters of inter State river Mahadayi diverted under the Kalasa – Bhanduri project? If so, does not such right have a higher priority over other uses of the waters of the said river?

(g) Whether, the State of Karnataka would be justified in diverting waters of the interstate river Mahadayi and its valley to the Kali rive for augmenting the generation of electricity under the existing Kali Hydro Power Project? If so, what extent of diversion is just and reasonable?

(h) Whether, the State of Karnataka is entitled to execute Kotni hydro power project on the interstate river Mahadayi for generation of electricity on a main river Mahadayi? If so, to what extent?

(i) As alleged, whether, the State of Goa and its inhabitants would be prejudicially affected by the executive actions of the

Government of State of Karnataka in the waters of Inter-State river Mahadayi and its valley?

5. EFFORTS MADE, IF ANY, TO SETTLE THE DISPUTE:

(i) There have been continuous discussions and correspondence at Officers' and Ministers' level between the State of Goa and Karnataka for many long years. The list of dates along with compilation of documents is prepared and enclosed (to this complaint) as Annexure-B (Colly.) which shows that:

1147

……..

……..

(e) As part of its equitable share, Karnataka, as an emergent measure proposed Kalasa and Bhanduri projects for diversion of only 7.56 tmc of water to meet the urgent necessity of drinking water requirements to twin cities of Hubli-Dharwad, which again was objected to by the State of Goa. When this project was cleared ‘in principle’ on 30.04.200 2 by the Ministry of Water Resources, GOI , State of Goa objected and filed a complaint dated 9th July, 2002 under the ISWD Act. In view of that complaint, the Government of India kept the ‘in principle’ clearance in abeyance in its letter dated 19th September, 2002. Thereafter Suit No. 4 of 2006 was filed by the State of Goa against Karnataka for referring the alleged water dispute concerning diversion for drinking water purposes to a Tribunal, which was

resisted by the State of Karnataka and this suit remains pending and the next date fixed is 26.07.2010.

REQUEST:

(i) ……

(ii) refer to the Tribunal so constituted for adjudication and decision, the water disputes and matters connected with or relevant to the water disputes (as well as interim measures) emerging

1148

from this letter of complaint and the Annexures hereto.”

606.

The Tribunal finds that prior to the reference of the present water dispute to this Tribunal, an Original Suit bearing OS No. 4 of 2006 was filed by the State of Goa before the Hon'ble Supreme Court of India. All the grievances were raised in the said civil suit by the State of Goa, which have been pleaded before this Tribunal by the said State in its Statement of Claims. A specific grievance was raised with regard to diversion of water from Mahadayi basin to Malaprabha basin, through KalasaBhanduri project. A prayer was made in the aforesaid civil suit for constituting a Water Disputes Tribunal.

607.

The aforesaid Original Suit was contested by the State of Karnataka. All the pleas taken by the State of Goa were controverted by the State of Karnataka, and a similar stand was taken by the Karnataka before the Hon'ble Supreme Court, which has been taken by it before this Tribunal. During the pendency of the aforesaid civil suit before the Hon'ble Supreme Court, the Central Government constituted the present Mahadayi Water Disputes Tribunal, vide a Notification dated 16.11.2010, and

thereafter a reference dated 11.01.2011 was made by the Government of India to this Tribunal, which reads as follows:

“ REFERENCE

In exercise of the powers conferred by sub-section (1) of section 5 of Interstate River Water Disputes Act, 1956 (33 of 1956), the Central Government hereby refers to the Mahadayi Water Disputes Tribunal for adjudication, the water dispute regarding the Inter-State river Mahadayi and the river valley thereof, emerging from letter Nos. 68-4/CE-WRD-EO-2002-03/208 dated 09th September, 2002 & letter No. CE/MandoviBassin/2006-07/198 dated 10th January, 2007 from Government of Goa, letter No.WRD-8-KMD-09 dated 26th June, 2010 from Government of Karnataka and letter No.Mandovi-2010/CR-247/WRP dated 13th September, 2010 from Government of Maharashtra.”

608.

However, on account of a typographical error in a

date in the aforesaid reference Notification, a Corrigendum dated 09.02.2011 was issued for correcting the said error, which reads as under:

“ CORRIGENDUM

In the REFERENCE made to the Mahadayi Water Disputes Tribunal vide this Ministry letter of even no. dated 11th January, 2010, the date of letter no. 68-

1150

4/CE-WRD-EO-2002-03/208 may be read as 09th July, 2002.”

609.

On 20.01.2011, when the aforesaid Original Suit was taken up for hearing by the Hon'ble Supreme Court, the matter of issuance of Notification dated 16.11.2010, issued by the Central Government, constituting the Tribunal to decide the aforesaid water disputes between the party states was brought before the Hon’ble Supreme Court. Accordingly, the aforesaid Original Suit filed by the State of Goa was disposed of by the Apex Court by passing the following order was passed:

“ O R D E R

In our order dated 22nd November, 2010, we referred to and recorded regarding issuance of the Notification dated 16.11.2010, issued by the Central Government, constituting a Tribunal to decide the water dispute relating to the inter-State River Mahadayi and the River Valley.

However, besides the said Notification a separate

Notification was also required to be issued by the Union of India by way of referring the entire disputes to the said Tribunal. Two weeks' time was granted to the Central Government for doing the needful in the matter.

Pursuant to the said order a further Notification is issued by the Union of India under Notification dated 16.11.2010 for adjudication of the water dispute regarding the inter state River Mahadayi and the River Valley thereof. In the said order, the Central Government has referred to the Tribunal the request and complaints received from the Government of Goa, Government of Karnataka and Government of Maharashtra regarding the water dispute but while mentioning about the letters of request in the notification, there is some clerical mistake.

Be that as it may be, since there has been request of the aforesaid three State Governments for referring the water dispute to the Tribunal, we take the aforesaid Notification on record whereby all the disputes regarding the inter-State River Mahadayi and the River Valley thereof are referred to the aforesaid Tribunal for adjudication and decision. In view of this order, all the issues, that have been raised in this suit,

could be effectively raised before the aforesaid

Tribunal in accordance with law.

In view of the aforesaid order, nothing survives in

this Original Suit, which stands disposed of accordingly.

All the applications also pending, stand disposed

of in view of this order.

(Dr. MUKUNDAKAM SHARMA) J

(ANIL R. DAVE) J

1152

NEW DELHI,

JA NUARY 20,2011."

610.

It would also be relevant to notice that the State of Maharashtra, though not a contesting party against the State of Karnataka,at that stage, was also impleaded as a party respondent in the proceedings before the Supreme Court.

611.

After the present Tribunal was constituted, and the reference was received from the Government of India, the cognizance of the matter was taken and the proceedings were initiated. The parties were directed to file their respective Statements of Claims.

612.

A Statement of Claim was filed by the State of Karnataka on 02.01.2013 (Volume 10). Besides, taking up various pleas and besides setting up its own claims in this water dispute, and taking up the pleas in that regard, an objection was also raised regarding the effect of deletion of paras 28(iv) and 28(v)

from Goa’s complaint dated 09.07.2002. The aforesaid objection raised by the State of Karnataka is in paras 4.1 to 4.10, (Page 58, Volume 10) and is extracted as below:

1153

“C.

Effect of deletion of paras 28(iv) and 28(v)

from Goa's complaint dated 09.07.2002;

4.1 The State of Goa filed its Complaint dated

09.07.2002 (amended) urging the Central Government;

Secretary, Ministry of Water Resources, Government

of India to immediately constitute a Judicial Tribunal as

provided under Section 3 of the Inter State Water

Disputes Act, 1956 as amended and to refer for

adjudication the following:

"28.

(i) To adjudicate and decide correctly the

available utilizable water resources of the

Mandovi basin at 75% dependability at various

points in the basin and at Karnataka's disputed

project sites.

(ii) To adjudicate and decide the equitable

shares of the three co-basin states in the above

quantity of water taking into consideration the

long term in basin needs of the three States for the beneficial uses of water (water supply, irrigation, hydro-power generation, navigation, pisci-culture and environmental protection, etc.)

(iii) To adjudicate and decide whether in basin needs to be given priority over any contemplated extra basin diversions and whether there is any surplus left for extra basin diversions after adequately providing for long term in basin needs.

(iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

(v) To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins.

(vi) To adjudicate and decide specific restraints or restrictions to be placed on the upstream riparian states with regard to construction and regulation of their project~ during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters.

(vii) To adjudicate and decide the machinery to

implement the decision of the Tribunal”.

4.2 The State of Karnataka by its letter dated 12.01.2010 requested the Union Government to "delete reference of KalasaBhandura project to the proposed Tribunal' on the ground that drinking water requirement has the highest priority among the various uses of water and therefore such "requirement should be seen as an issue relating to right to

livelihood under Article 21 of the Constitution rather than as regular water Disputes under the provision of the Inter- State River Water Disputes Act,1956".

(A copy of the letter dated 12.01.2010 by the Chief Minister of Karnataka to the Prime Minister of India, is annexed hereto and marked as Annexure-46).

4.3 On 26.03.2010, the Union Government replying to the above letter dated 12.01.2010 stated that –

"As regard to deleting reference of KalasaBhandura project to the proposed Tribunal; the Govt. of Goa vide its letter dated 10.1.2007 has deleted the reference to the issues related to providing water to Hubli and Dharwad Cities from the complaint to be referred to the Tribunal."

(A copy of the letter dated 26.03.2010 by the Minister, Water Resources to Chief Minister, Government of Karnataka is annexed hereto and

marked as Annexure-47).

4.4 Till that date the State of Karnataka was not aware nor made aware of letter dated 10.1.2007 by Goa. It appears that by letter dated 10.01.2007, the State of Goa had agreed to delete paras 28(iv) and 28(v) in its complaint dated 09.07.2002 filed under Section 3 of the Act of 1956. The letter is extracted below:

"After due consideration your request vide letter dated 4/1/2007 by the Government of Goa, I am directed to inform you that the Goa's request for appointment of Tribunal under ISRWD 1956 may be processed by deleting the para 28(iv) & 28(v) without prejudice to any other contents in the Goa's request letter of 9/7/2002."

(A copy of the letter dated 10.01.2007 by Office of Chief Engineer, Water Resources, Goa to the Ministry of Water Resources, GOI is annexed hereto and marked as Annexure-48).

4.5 The deleted paras viz., para 28(iv) and 28(v) of the complaint dated 09.07.2002 filed by Goa are extracted below:

"28 (iv)

To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available

water resources.

(iv) To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins'.

4.6 The Complaint of Goa was, along with the complaints of other two States, referred to the Mahadayi Water Disputes Tribunal on 11th January, 2011 on the following terms:

"In exercise of the powers conferred by sub-section (1) of section 5 of the Inter-State River Water Disputes Act;. 1956 (33 of 1956), the Central Government hereby refers to the Mahadayi Water Disputes Tribunal for adjudication the water dispute regarding the Inter-State river Mahadayi and the river valley thereof emerging from letter Nos. 68-4/CE-WRD-EO-2002-03/208 dated 10th September 2002 and letter no. CE/Mandovi Basin/2006-07/198 dated 10th January, 2007 from the Government of Goa, letter no. WRD-8- KDM-2009 dated 26th June 2010 from Government of Karnataka and letter No. Mandovi-2010/CR-247/WRP dated l1 th October, 2010 from Government of

Maharashtra".

4.7 It will be appreciated that since specific reference is made to the letter of Government of Goa dated 10.01.2007 there can be no adjudication with respect to whether Karnataka cannot meet the Hubli-Dharwad water supply requirements from locally available water resources as had been contended by Goa or that the water supply needs of Hubli-Dharwad towns being of highest priority over irrigation and hydro-power generation under the projects in Kali, Bedti and Ghataprabha basins. With the deletion of para 28(iv)

and 28(v) of the complaint and these items being dropped from the reference, the case must proceed on the basis that the water supply requirements for drinking water can only be met from Mahadayi river.

4.8 The State of Karnataka submits that after the deletion of paras 28(iv) and 28(v) from complaint dated 09.07.2002 as discussed above, it is not open to the State of Goa to plead against the diversion of 7.56 tmc of water under the ongoing KalasaBhandura project.

4.9 Goa has waived its right to agitate against KalasaBhandura project or the drinking water requirement of Hubli Dharwad twin cities. Goa is also barred either by estoppel or waiver from re-agitating against the KalasaBhandura project or the drinking water requirement of Hubli Dharwad twin cities. As submitted above, Goa had specifically agreed and/or not objected to the Kalasa project of Karnataka in the interstate meetings held on 10.09.1996 and

04.10.1996 and the deputy Chief Minister of Goa had specifically appreciated the project as a "good project and it can be beneficial to both the States" in the Interstate meeting held on 10.01.2000. Even, the Union Ministry of Water Resources while granting "in-principle clearance" by its letter dated 30.04.2002 had proceeded on its understanding that Goa has no objection to the KalasaBhandura project (see the "abeyance" letter dated 19.09.2002). Karnataka submits that if Goa cannot plead on these issues, then it is no longer open to question the KalasaBhandura project.

4.10 However, without prejudice to the above contentions on the effect of deletion of paras 28(iv) and 28(v) by Goa from its complaint, Karnataka has dealt with drinking water needs of Hubli-Dharwad in the Statement of Claims."

613.

The State of Goa also filed its Statement of Claims on 04.02.2013 (Volume 28). The history of the water dispute, various pleas taken by the State of Goa, and also the objection to the diversion of water from Mahadayi basin to Malaprabha basin, through Kalasa-Bhanduri project, have been detailed.

614.

The State of Karnataka filed its reply to the Statement of Claims filed by the State of Goa, vide its reply dated 18.3.2013, (Volume 33). In the aforesaid reply, the State of Karnataka denied the various pleas raised by the State of Goa, and also raised an objection to the adjudication of the claims made by Goa on account of deletion of paras 28(iv) and 28(v) from Goa's complaint dated 09.07.2002. The relevant extract, from the reply

filed by the State of Karnataka, vide Volume 33, isreproduced below:

“(xii) After the deletion of paras 28 (iv) and 28(v) from its Complaint dated 09.07.2002 vide letter dated

10.01.2007 to make it maintainable for the reference under Sec. 5(1) of the Act of 1956, Goa is estopped from raising the issues by pleading against or questioning the legality of diversion of 7.56 tmc of water under the ongoing KalasaBhanduri project for meeting the drinking water requirement of twin cities of Hubli-Dharwad etc.

(Complaint of Goa dated 09.07.2002 is attached as Annexure R-3 to the reply filed by Karnataka to Goa's I.A. No. 1 of 2012 before this Tribunal at pages 51-91 and Annexure R-6 to the said Reply is attached the letter dated 10.01.2007 at page 98).

2.90 In Re: Para 153 – The contents of para 153 are vehemently denied. It is denied that the State of Karnataka has illegally proceeded with the works and that it is an attempt to create a 'fait accompli'. It is also denied that "an attempt is being made to justify diversions, citing alleged need of Hubli-Dharwad drinking water requirement when the entire attempt is

to divert water for irrigation purposes". It is submitted that Goa had agreed to the deletion of paras 28(iv) and 28(v) of its complaint dated 09.07.2002 which relate to the KalasaBhanduri project planned by Karnataka for meeting the drinking water requirement of Hubli-Dharwad and thereafter estopped from raising the said issue. It is further denied that the water available in the Mahadayi basin is being mismanaged and misutilized. It is further denied that the entire attempt is to put into jeopardy the very sustenance of Mahadayi River and the Mahadayi River Basin."

1161

615.

The State of Goa also filed a reply to the Statement of Claims of Karnataka, (Volume 10), through its reply dated 14.05.2013, (Volume 38). The objection taken by the State of Karnataka with regard to deletion of paras 28(iv) and 28(v) was also strongly contested. The following pleas were taken by the State of Goa in the aforesaid reply:

“56. In Re. Para 4.1 to 4.10 of the Statement of case of Karnataka dated 02/01/2013: State of Goa states and submits that what has been stated by State of Karnataka in the said paragraphs are mere contentious averments alleged to be the effect of the deletion of paras 28 (iv) and 28 (v) from Goa's complaint letter dated 09/07/2002. State of Goa admits that by a communication dated 10/01/2007, they have agreed for deletion of paragraph 28 (iv) & 28 (v) of their complaint letter dated 09/07/2002. State of Goa's justification for doing so, are inter alia is submitted as under:-

1. It took Goa almost nine long years to get this important dispute matter concerning its vital interests referred to a judicial tribunal for justice as provided under the law.

2. Karnataka's case for deletion of Goa's reference for Tribunal's adjudication of Kalasa Bandura project's proposals for outside-the-basin diversion is on that ground that drinking water has the highest priority among the various uses of water and therefore such requirement should be seen as an

Issue relating to livelihood under Article 21 of the Constitution of India, rather than a regular Water Dispute under the provision of the Inter-State Water Dispute Act, 1956.

3. The State of Goa denies the aforesaid contention of Karnataka. If water supply is of higher national priority as contended, it is inconceivable as to why Karnataka cannot reduce its own irrigation use of 27 tmc from Malaprabha or Hydropower generation on Kali Nadi to meet the priority requirement.

4. It has to be clarified that Goa Government did not agree to deletion of its demands in para 28 (iv) & 28 (v) for reference to this Tribunal because of any of the reasons as alleged by the State of Karnataka in their present Statement of Case. Goa government had to agree to this deletion due to following legal constraints:¬-

a. Hubli -Dharwad are located in Krishna Basin in Malaprabha, Ghataprabha and Tungabhadra sub

basins. The local availability of water in these basins and the reasonable needs for various uses to be granted are under dispute before the Krishna Water Dispute tribunal. The Krishna Tribunal's hearings are still under progress. Therefore, the contention of MoWR as manifested from the Letter dated 21/11/2006 was that it would not be legally permissible for the Mahadayi River Water Dispute Tribunal to adjudicate on issues pending before another Judicial Tribunal and being adjudicated. It was

under this legal constraint that Goa agreed to delete the said paras 28(iv) & 28(v).

b. If it is Karnataka's contention that Goa is estopped from arguing against Karnataka's outside the basin diversion because of deletion of clauses 28(iv) and 28 (v), then it would be Goa's contention (without prejudice to the aforesaid submission) that Karnataka is estopped from arguing about the water supply needs of Hubli-Dharwad as they are located in Krishna Basin and the needs and availability of water for these needs are under adjudication before the Krishna Water Dispute Tribunal.

c. As already explained, Goa Government agreed for deletion of specific reference of clauses under 28(iv) and 28(v) before this Tribunal due to this legal constraints and the fear that if insisted upon by it, the matter may go to Supreme Court and the constitution and

proceedings of the Mahadayi Dispute Tribunal may get further delayed enabling Karnataka to make its outside basin diversion a fait accompli.

d. Without prejudice to the aforesaid submission, it is respectfully submitted by the State of Goa that the issues covered by the Paragraphs 28(iv) & 28(v) can very well be agitated/raised before the present tribunal as the same issues are also covered in Karnataka's complaint dated 22/06/2010 [and more

particularly issue No. (f)] which is also a specific matter of dispute before this Hon'ble Tribunal.

From the aforesaid facts, the double standard of the Union Ministry of Water Resources (MoWR) is also apparent as the MoWR vide letter dated 21/ 11/2006 directed the State of Goa to delete Paras 28(iv) & 28(v) on the grounds that that it would contain references to basins other than the Mahadayi Basin. However, identical issues concerning Hubli-Dharwad region have been allowed to be retained in Karnataka's complaint dated 22.06.2010, which has been referred to the present Hon. Tribunal for adjudication.

It is humbly submitted that in spite of the above legal constraint Karnataka if permitted by this Hon'ble Tribunal to plead its needs for Hubli-Dharwad water supply which is in Krishna basin, then the State of Goa may also have to be permitted to plead before this Hon'ble Tribunal the water resources available in Krishna basin (Ghataprabha, Malaprabha,

Thungabhadra) and how it is adequate to meet these needs. Under these circumstances, Goa reserves its right to further add and elaborate its reply to paras 4.1 to 4.10 during the course of detailed arguments after the correct position is known. The entire correspondence in this respect between Goa Govt. and Central Govt. are enclosed herewith as Annexure 19 collectively.

It is further submitted that Maharashtra has pleaded in their Statement of Case, that if Karnataka is

permitted by the Hon. Mahadayi Water Dispute Tribunal to divert Mandovi River waters to Malaprabha sub basin in Krishna Basin, then they would consider it as an augmentation of the available Krishna water yield and claim a share in Krishna Basin. In that case Andhra Pradesh will also step in and claim a share. This will open up a whole Pandora's box of complications and endless disputes dragging the small State of Goa into a long legal battle after depriving it of its in basin needs."

616.

On 15.07.2013, the State of Karnataka filed a rejoinder to the reply filed by the State of Goa, to the Statement of Claims filed by Karnataka. In the aforesaid rejoinder, (Volume 46), the State of Karnataka again reiterated its objection with regard to the deletion of the paras 28(iv) and 28(v) by the State of Goa as follows:

"4(30) In re: Paras 56 and 57: Karnataka does not admit any of the contentions raised by Goa in paras 56

and 57 of the Reply. Karnataka reiterates its contentions made in paras 4.1 to 4.10 of its Statement of Claims. The suggestion for reduction of irrigation under Malaprabha project to provide drinking water to Hubli- Dharwad is not a justified solution at all. Karnataka has already cut down its irrigation in Malaprabha from 44 tmc to 27 tmc, which is about 38.60% of the planned irrigation. The existing facility of farmers to receive waters from Malaprabha project acquired from 1970 onwards cannot be deprived.

1166

The Mahadayi water of 220 tmc at 50% dependability and 199.6 tmc at 75% dependability, a large part of which is going as waste to sea at present, is the only solution to meet the drinking water needs of Hubli-Dharwad. The State of Karnataka reserves Its right to refer to paras 13.2 to 13.14 of the Statement of Claims in support of its argument."

617.

In the aforesaid Rejoinder (Volume 46), the relevant portion of the pleas taken by Karnataka in para 4(46) (page 54) may be noticed as below:-

"….Karnataka submits that it requires about 7.56 tmc by 2044 to meet the requirement of projected population of 21,27,878. Karnataka denies that the requirement of Hubli-Dharwad, etc., may be met from Kali nadi or Malaprabha by reducing the existing requirements therein. Karnataka submits that diversion from Kali is not a feasible proposition at all. Kali is a deficit basin. The cost of diversion from Kali to

Hubli-Dharwad is almost five times more than the cost of diversion of Mahadayi water to Malaprabha basin as planned. Therefore, it is considered as totally uneconomical. Similarly, other alternatives suggested by Goa in the Complaint from Bedthi is also not feasible. Bedthi is a deficit basin and the cost of diversion is more than three times than the cost of diversion of Mahadayi water to Malaprabha basin as planned. Karnataka reserves its right to lead evidence in this regard. ...”

1167

618.

On 16.04.2014, a rejoinder, (Volume 77), was filed by the State of Goa to the reply filed by State of Karnataka to the amended Statement of Claims by Goa. The State of Goa reiterated its stand on the aforesaid objection raised by Karnataka as follows:

“C) The State of Goa denies the aforesaid contention of Karnataka. If water supply is of higher national priority as contended, it is inconceivable as to why Karnataka cannot reduce its own irrigation use of 27 TMC from Malaprabha or Hydropower Generation on Kali Nadi to meet the priority requirement. It is submitted that the State of Goa did not agree to deletion of its demands as contained in paras 28(iv) & 28(v) on account of any reasons as alleged by the State of Karnataka as aforesaid. The State of Goa had to agree to this deletion due to following legal constraints:

(i)

The Ministry of Water Resources of Government of India addressed a letter dated 21.11.2006 to the Government of Goa stating that paragraphs 28(iv) and 28(v) of the complaint dated 9.07.2002 filed by the State of Goa was examined by the Central Government and it was found that the same contained references to basins other than Mahadayi. It was further stated therein that as per Section 3 of the Interstate Water Disputes Act, 1956, the dispute/complaint in connection with a particular interstate river or river valley

could be referred to the Tribunal and not of multiple basins. In the said letter, it was further stated that the request of the Government of Goa in the present form could not be referred to the Tribunal for adjudication of the dispute. It was under this legal constraint that the State of Goa agreed to delete the said paras 28(iv) and 28(v) from its complaint dated 9.07.2002.

(ii)

Without prejudice to what is stated herein above, it is respectfully submitted that if the State of Karnataka's contention is that Goa is estopped from arguing against the Karnataka's outside the basin diversion because of deletion of the aforesaid paragraphs 28(iv) and 28(v), then likewise the State of Karnataka would also be estopped from arguing about the water supply needs of Hubli-Dharwad as they are located in Krishna Basin and the needs and availability of

water for these areas are under adjudication before the Krishna Water Disputes Tribunal.

(iii) As already explained, the State of Goa agreed to the deletion of the specific reference of paragraphs 28(iv) and 28(v) before this Hon'ble Tribunal due to this legal constraint and the fear that if insisted upon by it, the constitution and proceedings of the Mahadayi Dispute Tribunal may get further delayed enabling the State of Karnataka to make its outside basin diversion and present a fait accompli in the matter.

(iv) Without prejudice to the aforesaid submission, it is respectfully submitted by the State of Goa that the issues covered by the paragraphs 28(iv) & 28(v) can very well be agitated/raised before this Hon'ble Tribunal as the same issues are also covered in the State of Karnataka’s comp laint dated 22.06.2010 [and more particularly issue No. (f)], which is also a specific matter of dispute before this Honourable Tribunal.

(v)

Without prejudice to the aforesaid contention, it is submitted that clauses (i), (ii), (iii), (vi) and (vii) of the letter dated 9.07.2002 addressed by the State of Goa amply entitles the State of Goa to seek directions from this Honourable Tribunal in respect of the impugned projects.

(vi) From the aforesaid facts, the double standard of the Union Ministry of Water Resources is also apparent as the Ministry of Water Resources

vide letter dated 21.11.2006 directed the State of Goa to delete paras 28(iv) & 28(v) on the grounds that it would contain references to basins other than the Mahadayi basin. However, identical issues concerning Hubli-Dharwad region have been allowed to be retained in State of Karnataka's complaint dated 22.06.2010, which has been referred to this Honourable Tribunal for adjudication.

(vii) In any event of the matter, deletion of paras 28(iv) and 28(v) from the reference is different and distinct from raising an argument to counter

the diversion based on issues arising in Hubli – Dharwad region, wherein, in pleadings, and in evidence as also while arguing it is always open to the State of Goa, to raise the same as and by way of arguments and counter reply to Karnataka."

619.

The State of Karnataka on 20.04.2015 filed an amended Statement of Claims, (Volume 129). In the aforesaid Statement of Claims, Karnataka reasserted and reiterated its objection with regard to the maintainability and adjudication of the claims made by the State of Goa, on account the deletion of paras 28(iv) and 28(iv) from its complaint. Identical pleas were taken in this amended Statement of Claims, as well, by the State of Karnataka , as were taken by it in its original Statement of Claims (Volume 10) filed on 02.01.2013.

620.

A reply was filed by the State of Goa, (Volume 134), on 05.05.2015, to this amended Statement of Claims by Karnataka.

The State of Goa, in the said reply, has specifically stated that “it repeats and reiterates all the averments and contentions raised by the State of Goa in its Reply dated 14.05.2013 (Sl. No. 38 of the List of Documents maintained by this Hon'ble Tribunal) to the

Statement of Claim filed by the State of Karnataka as if the same are specifically reproduced herein."

621.

An amended Statement of Claims, (Volume 131), having been filed by the State of Goa on 23.04.2015, the State of Karnataka also chose to file a reply thereto, (Volume 138), on 25.05.2015. Once again, Karnataka took up an objection with regard to the adjudication of the dispute to the claims made by the State of Goa on account of the deletion of the aforesaid paras from its claims. It would be also relevant to notice the aforesaid objection taken in the reply filed by the Karnataka as Volume 138, as follows:

"2.1 The respondent State of Karnataka submits that this Hon'ble Tribunal was constituted vide Notification dated 16.11.2010 issued by the Central Government under Sec. 4 of the Interstate Water Disputes Act, 1956 (Act of 1956). By order dated 11.01.2011 headed 'REFERENCE' the Central Government referred the Water Dispute to this Hon'ble Tribunal for adjudication

in the following terms:

“ REFERENCE

In exercise of the powers conferred by sub-section

(1) of section 5 of Interstate River Water Disputes

Act, 1956 (33 of 1956), the Central Government

hereby refers to the Mahadayi Water Disputes Tribunal for adjudication, the water dispute regarding the Inter-Starte river Mahadayi and the river valley thereof, emerging from letter Nos. 68-4/CE-WRD-EO-2002-03/208 dated 09th September, 2002 & letter No. CE/MandoviBassin/2006-07/198 dated 10th January, 2007 from Government of Goa, letter No.WRD-8-KMD-09 dated 26th June, 2010 from Government of Karnataka and letter No.Mandovi-2010/CR-247/WRP dated 13th September, 2010 from Government of Maharashtra. ”

Note: Letter No. 68-4/CE-WRD-EO-2002-03/208 dated 9th September 2002 was corrected vide corrigendum dated 09.02.2011 as “09th July 2002. ”

2.2 The letter of 09.07.2002 as corrected in the corrigendum dated 09.02.2011 was the complaint filed by the State of Goa wherein in paragraph 28, the

Government of India was strongly urged (by the State of Goa) to appoint a judicial tribunal as provided for under Sectio3 of the Interstate Water Disputes Act, 1956 as amended and refer the following matters for adjudication and decision:"

"28

i) To adjudicate and decide correctly the availability utilizable water resources of the Mandovi basin at 75% dependability at various

points in the basin and at Karnataka's project sites.

ii) To adjudicate and decide the equitable shares of the three co-basin states in the above quality of water taking into consideration the long term in basin needs of the three States for the beneficial uses of water (water supply, irrigation, hydro-power generation, navigation, pisci-culture and environmental protection, etc.,)

iii) To adjudicate and decide whether in basin needs to give priority over any contemplated extra basin diversions and whether there is any surplus let for extra basin diversions after adequately providing for long term in basin needs.

iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

v) To adjudicate and decide whether there are no other alternative sources available to Karnataka, such as the Kali, the-Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins.

vi) To adjudicate and decide specific restrains or restrictions to be placed on the upstream

riparian states with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable shares of the Mandovi river basin waters.

vii) To adjudicate and decide the machinery to implement the decision of the Tribunal."

2.3 Subsequently by an official letter dated 10.01.2007 to the Secretary, Ministry of Water Resources, the Government of India stated:

"After due consideration your request vide letter dated 4/1/2007 by the Government of Goa, I am directed to inform you that the Goa's request for appointment of Tribunal under ISRWR 1956 may be processed by deleting para 28(iv) & 28(v) without prejudice to any other contents in the Goa's request letter of 9/7/2002."

2.4 It was therefore, clear that the dispute referred for adjudication emerging from letter No. 68-4/CE-

WRD-EO-2002-03/208 dated 9th July 2002 from the Government of Goa the following matters were voluntarily deleted viz.

“28. iv) To adjudicate and decide whether Karnataka cannot meet Hubli/Dharwad water supply requirements from locally available water resources.

v) To adjudicate and decide there are no other alternative sources available to Karnataka, such as the Kali, the Bedti, the Ghataprabha etc., from which water supply needs of Hubli/Dharwad towns could be met as a higher priority than irrigation and hydropower needs in those basins."

The amended Statement of Claim, however, includes matters which had been unilaterally deleted. The averments in paragraphs inter alia 170, 171, 172, 174 & 193 of the Statement of Claim filed by Goa are clearly outside the scope of the reference made to the Hon'ble Tribunal and it is submitted that these paragraphs fall within items 28(iv) and 28(v) which have been deliberately and unilaterally deleted from the complaint (and correspondingly from the reference) by letter dated 10.01.2007. In each of these paragraphs, the Government of Goa has specifically referred to alternative locally available water resources to meet drinking water requirements of Hubli-

Dharwad etc. and has entered pleas about alternative sources allegedly available to State of Karnataka such as the Kali, the Bedti, the Ghataprabha and Malaprabha etc. from which the water supply needs of Hubli-Dharwad towns can be met.

2.5 The respondent State of Karnataka submits that, the jurisdiction of this Hon'ble Tribunal to adjudicate water disputes is circumscribed by the provisions of the Act of 1956. The Tribunal being a Court of limited jurisdiction cannot adjudicate on issues which are not

part of the Reference of the Central Government under Sec. 5(1) of the Act of 1956. The Respondent State of Karnataka further submits that the amended Statement of Claim filed by the State of Goa inter alia in paragraphs 154A, 154D, 154E, 154F, 154H, 154I, 154K, and 183A are entirely outside the scope of the reference and cannot form the subject matter of adjudication.

2.6 The respondent State of Karnataka further submits that the State of Goa can only plead in its Statement of Case that which is circumscribed by reference letter dated 11.01.2011 read with corrigendum dated 09.02.2011 issued under Sec. 5(1) of the Act of 1956."

622.

It would be relevant to notice that a full rejoinder, (Volume 144), was filed by the State of Karnataka on 24.06.2015 to the replies filed by the State of Goa to the two Statements of Claims filed by State of Karnataka. In the aforesaid rejoinder also,

the objection with regard to the adjudication of the claims of State of Goa were repeated by the State of Karnataka.

623.

It would also be pertinent to notice that a total of 70 issues, were framed by this Tribunal, arising from the pleadings of

the parties. The relevant issue No. 38, framed by the Tribunal is already reproduced earlier

624.

During the course of arguments, the objection raised by the State of Karnataka with regard to deletion of paras 28(iv) and 28(v) by Goa has been vehemently argued by Shri Ashok Desai, its learned Senior Counsel and Shri Mohan V. Katarki, the learned Counsel, and it has been maintained that after the said deletion, and consequential reference by the Central Government after the aforesaid deletion, this Tribunal cannot go into the allegations/averments of availability or alternate resources or locally available resources, to meet the drinking water requirement of Hubli-Dharwad, and that the water supply

needs of Hubli-Dharwad could be met as a high priority than irrigation and hydro-power needs in those basins. It has been further stressed that the State of Goa is estopped from re-agitating again issues deleted from the terms of reference. A strong reliance has been placed by the learned Senior Counsel on the letter dated 04.01.2007, of the Government of India, addressed to the State Government of Goa, whereby the State was asked to revise its request letter, and delete paras 28(iv) and 28(v). It has also been pointed out that in pursuance to the

aforesaid communication by the Government of India, the State Government of Goa issued a revised request letter on 10.01.2007, and revised its complaint by deleting the aforesaid two paragraphs. The learned Senior Counsel has maintained that on account of aforesaid deletion, there is no question to adjudicate the controversy involved under Issue No. 38 and as such the determination of Issue No. 38 has to be against Goa.

625.

The aforesaid contentions raised on behalf of the State of Karnataka have been vehemently contested and opposed by Shri Atmaram N.S. Nadkarni, the learned Senior Counsel appearing for the State of Goa. The learned Senior Counsel has referred to the history/background facts leading to the reference for constitution of this Tribunal. It has been pointed out that complaint under section 3 of the Act was sent by the Government of Goa to the Central Government on 09.07.2002, with the request to constitute a Water Disputes Tribunal, to adjudicate and decide the water dispute between the

State of Goa, Karnataka and Maharashtra. Later on, a communication dated 21.11.2006 was issued by the Government of India to the Government of Goa, whereby the Central Government required the Government of Goa to delete paras

28(iv) and 28(v) from the complaint, since it contained "referen ces to basins other than Mahadayi also. As per Section 3 of ISRWD Act, 1956, the dispute/complaint in connection with a particular inter-State river or river valley can be referred to the Tribunal and not for multiple basin, as such, the aforesaid request of Government of Goa, in the present form cannot be referred to the Tribunal fo r adjudication of the dispute". In the circumstances, the Government of Goa was requested to send a revised request for taking further action in the matter.

626.

It has also been pointed out by the learned Senior Counsel for Goa that through a letter dated 13.12.2006, the Government of Goa replied to the said communication of the Government of India, and maintained that since the basic principle was that the water needs of the basin should be met before considering any diversion outside the basin, therefore, water should not be diverted outside the water deficient Mandovi/Madei basin to surplus Malaprabha basin. The detailed facts were given in the said communication, and the request was

repeated to constitute the Tribunal immediately.

1180

627.

It has further been pointed out by the learned Senior Counsel that in response to the said communication of the Government of Goa, the Government of India wrote another letter dated 04.01.2007, whereby the Government of Goa was again requested to send a revised request by deletion of paras 28(iv) and 28(v). The learned senior counsel has brought to our pointed attention that Government of India maintained that since the augmentation of water in river Krishna was already a matter of adjudication before the Krishna Water Disputes Tribunal, therefore, the prayers made in paras 28(iv) and 28(v) would lead to conflict over the jurisdiction with existing KWDT, which was not permitted under the provisions of the Act. The learned Senior Counsel points out that it was in that background, and keeping in view the urgency of the matter, that the Government of Goa had written the letter dated 10.01.2007, whereby the paras 28(iv) and 28(v) were deleted from the complaint dated 09.07.2002. However, the learned Senior Counsel emphasizes that it was specifically maintained by Goa

that the aforesaid deletion of the paras 28(iv) and 28(v) was “without prejudice to any other contents in the Goa’s request letter of 09.07.2002.”

1181

628.

In the aforesaid background, the learned Senior Counsel argued that the deletion of paras 28(iv) and 28(v) from the complaint of Goa cannot be looked into in isolation, but the entire background/history of the case has to be kept in mind for doing so, more so, when a specific right had been reserved by Goa that the aforesaid deletion was without prejudice to any other contents of the Goa's request letter dated 09.07.2002. To stress the aforesaid contentions, the learned Senior Counsel has taken us through the entire complaint dated 09.07.2002 filed by Goa. Our pointed attention has been drawn to various facts stated in the complaint, wherein specific pleas have been taken with regard to diversion of water from Mahadayi basin to Malaprabhabasin which, inter-alia, include paras 8, 12.8 and 25.0 of the complaint.

629.

The learned Senior Counsel for the Goa has also referred to two other letters, which are appended as Annexure 20 and Annexure 21 to Volume 38, (at pages 137 & 138

respectively), being dated June 2, 2010 (Annexure 21) and April 9, 2013 (Annexure 20). It has been pointed out that the matter of deletion of paras 28(iv) and 28(v) from complaint of Goa was taken up by Goa with the Central Government, and the Central

1182

Government had clarified that “the issue of deciding available utilizable water resources of Mahadayi basin, its equitable distribution and extra basin diversion are still part of the complaint.”

630.

Before proceeding any further, it will also be for the Tribunal to notice the aforesaid appropriate communications. The said two communications are extracted as follows:

“ Annexure-21

PAWAN KUMAR BANSAL

Minister of Parliamentary Affairs

&WATER RESOURCES

GOVERNMENT OF INDIA

NEW DELHI-110001

D.O.No.5/4/2010-BM 2 JUNE 2010

Dear ShriBasavarajBommai,

Kindly refer to your letter dated 19th April, 2010 regarding the reference of providing water to Hubli& Dharwad cities from Mahadayi river by State of Goa.

I have had the matter examined. The Government of Goa vide its letter dated 10.1.2007 (copy enclosed) has

deleted the Para 28(iv) and 28(v) of its complaint dated 9.7.2002 (copy enclosed) having reference to the issue related to providing of drinking water to Hubli& Dharwad cities as the matter contained in these paras were linked to the river basins other than Mahadayi river basin. However, the issue of deciding available utilizable water resources of Mahadayi basin, its equitable distribution and extra basin diversion are still part of the complaint. The Central Government has approved the construction of Mahadayi Water Disputes Tribunal in this regard on 10.12.2009 and the whole issue will be adjudicated by the Tribunal.

With regards,

Yours sincerely,

Sd/-

(PAWAN KUMAR BANSAL)

ShriBasavarajBommai,

Minister for Water Resources

(Major & Medium Irrigation)

Government of Karnataka,

Room No. 327, 3rd Floor,

VidhanaSudha,

Bangalore- 560001."

"Annexure -20

Harish Rawat

Minister of Water Resources,

Government of India

F.No. No.5/4/2010-BM

09 APR 2013

1184

Dear Shri ParrikarJi,

Kindly refer to your letter dated 18.10.2012 wherein this Ministry was requested to inform Government of Karnataka regarding the factual stand of Goa Government on inter-State Mahadayi Water Disputes Tribunal which does not delete any references of Kalsa-Bhandura Project.

I have had the matter examined. The Goa Government vide letter dated 10.1.2002 has deleted only the paras 28(iv) and 28(v) of its complaint dated 9.7.2002 having reference to the issue related to drinking water requirements assessment of Hubli& Dharwad cities as the matter contained in these paras were linked to the river basins other than Mahadayi basin. However, the issue of deciding available utilizable water resources of Mahadayi basin, its equitable distribution and extra basin diversion including KalsaBhandura Project are still part of the complaint. The Government of Karnataka has already been informed on the same issue by this Ministry, vide

letter dated 2.6.2010 (Copy enclosed).

Since the Central Government has constituted Mahadayi Water Disputes Tribunal in this regard, vide notification dated 16.11.2010. The whole issue has been referred to the Tribunal, vide letter dated 11th January 2011 and 9th February, 2011. The matter is now to be adjudicated by the Tribunal.

With regards,

Yours sincerely,

1185

Sd/-

(HARISH RAWAT)

Shri Manohar Parrikar

Hon’ble Chief Minister of Goa,

Government of Goa

Goa Secretariat

Panjim (Goa).”

631.

Further, Shri Nadkarni, the learned Senior Counsel for Goa has submitted that the State of Karnataka had also filed a complaint dated 22.06.2010, under section 3 of the Act raising a water dispute before the Central Government. The Tribunal has been taken through the contents of the aforesaid complaint of Karnataka, more specifically para 3 (page 30 Volume 62A) (already reproduced above), wherein Karnataka has claimed that it is entitled to execute the KalasaBhandura project (Drinking Water Project), and divert 7.56 tmc of water every year to the Malaprabha river, and had also raised an issue as to whether the inhabitants of twin city of Hubli-Dharwad town and villages have

a right to drinking water from the waters of inter-State River Mahadayi diverted under the Kalasa-Bhandura project. The learned Senior Counsel draws Tribunal's attention to the reference made by the Central Government to this Tribunal, wherein the aforesaid complaint filed by Karnataka was also

referred and also forms a part of adjudication, along with another complaint dated 13.9.2010 filed by the Government of Maharashtra, raising its own claims in the water dispute.

632.

The order dated 20.1.2011, passed by the Hon'ble Supreme Court of India, in original Suit No. 4 of 2006, filed by State of Goa, in the matter, has also been strongly relied upon. It has been pointed out by the learned Senior Counsel for the State of Goa that in the proceedings before the Hon'ble Supreme Court, all the pleas, which have been raised in the present proceedings before this Tribunal by Goa, had been taken, and the matter was being contested by the State of Karnataka. During the pendency of the proceedings before the Apex Court, this Tribunal was constituted by the Central Government, and accordingly the aforesaid civil suit was disposed of on 20.1.2011. Operative portion of the order of the Hon'ble Supreme Court is as under:

"Be that as it may be, since there has been request of the aforesaid three State Governments for referring the water dispute to the Tribunal, we take the aforesaid

Notification on record whereby all the disputes regarding the inter-State River Mahadayi and the River Valley thereof are referred to the aforesaid Tribunal for adjudication and decision. In view of this order, all the issues, that have been raised in this suit, could be

effectively raised before the aforesaid Tribunal in accordance with law.

In view of the aforesaid order, nothing survives in this Original Suit, which stands disposed of accordingly. All the applications also pending, stand disposed of in view of this order."

633.

Thus, the learned Senior Counsel maintains that the Hon'ble Supreme Court had disposed of the suit and directed that "all the issues, that have been raised in this suit, could be effectively raised before the aforesaid Tribunal in accordance with law." It is thus argued that the directions of the Hon'ble Supreme Court were very clear that all the issues which had been raised before the Supreme Court by the parties, could be raised before this Tribunal and as such were to be adjudicated.

634.

In these circumstances, it is vehemently asserted by Shri Nadkarni, the learned Senior Counsel appearing for Goa, that the objection raised by the State of Karnataka on the basis of

deletion of paras 28(iv) and 28(v), from the complaint of Goa is of no consequence and is liable to be rejected.

1188

635.

The

Tribunal

has

given

due

and

thoughtful

consideration to the aforesaid contentions raised by the learned senior counsel for the State of Karnataka and the State of Goa, respectively, and has also considered the record of the case on this aspect of the matter.

636.

It is not a matter of any dispute between the parties that the original complaint dated 09.07.2002 filed by the State of Goa did contain paras 28(iv) and 28(v), when the request was made to the Central Government for the appointment of a Tribunal. Later on, as already noticed, because of the view of the Central Government that the aforesaid paras may result in a

conflict of jurisdiction of the two Tribunals, viz. Krishna Water Disputes Tribunal, which was already adjudicating a water dispute with regard to Krishna River Water, and the Mahadayi Water Disputes Tribunal, which was yet to be constituted at that point of time, Goa agreed to delete paras 28(iv) and 28(v) of the complaint. However, while deleting the said paragraphs, a right was specifically reserved that the aforesaid deletion would be without prejudice to any other contents in the Goa's request letter of 09.07.2002. It is thus clear that although there was a deletion of paras 28(iv) and 28(v) of the complaint, but the

remaining contents of the complaint, which contained detailed facts with regard to the disputes between the parties, the grievance of the State of Goa with regard to diversion of water through KalasaBhanduri project etc., remained intact, and vide the reference dated 11.1.2011 by the Central Government to this Tribunal, the aforesaid complaint, with the deletion of only those two paragraphs, was referred for adjudication. In view of the aforesaid reference made by the Central Government and keeping in view the disputes between the parties, the Tribunal is duty bound in law to adjudicate all the pleas raised by the State of Goa in its Statement of Claims, which is primarily based upon the aforesaid complaint dated 09.07.2002.

637.

It may also be relevant to notice here that the Central Government had asked the State of Goa to delete those two paragraphs from its complaint, merely to avoid a possible conflict of jurisdiction between KWDT and this Tribunal, which was yet to be constituted at that point of time. However, the aforesaid situation cannot possibly remain alive now on account of two

reasons. Firstly, the Krishna Water Disputes Tribunal has already concluded its proceedings and had given its final Award on 20.12.2010. Secondly, the various pleas/facts stated by Goa in its

complaint dated 09.07.2002, and various pleas taken by it in the Statement of Claims, do not indicate any objection of the State of Goa with regard to water from any source/diversion augmenting river Krishna. In such a situation, the “question of any conflict of jurisdiction ” between this Tribunal, or any other Tribunal/Court would not arise. The State of Goa is primarily aggrieved against the proposed diversion of water from Mahadayi river to Malaprabha Reservoir i.e. outside the Mahadayi basin.

638.

Still further, as already noticed above, the State of Karnataka had also filed its complaint under section 3 of the Act on 13.10.2010, raising a water dispute against Goa, with regard to Mahadayi river and its basin. The aforesaid dispute has also been referred for final adjudication to this Tribunal, along with the water dispute raised by the State of Goa. The facts contained in the complaint of Karnataka have already been noticed above. It is clear that Karnataka has also raised a grievance against the Government of Goa, in protesting against and attempting to prevent works undertaken for diversion of 7.56 tmc of water in

the Inter-State Mahadayi River with regard to Kalasa-Bhanduri project, and has also claimed that it is entitled to execute the KalasaBhanduri project, which is stated to be a drinking water

project, and has further claimed that inhabitants of twin city of Hubli-Dharwad town and villages, have a right to drinking water from the waters of inter-State river Mahadayi, diverted under KalasaBhanduri project. The aforesaid pleas have also been raised by Karnataka in its Statement of Claims. The said claim of Karnataka has been contested by State of Goa. In this view of the matter, and the controversy between the parties, and as per the issue arising before this Tribunal for adjudication, and also as per the reference made to this Tribunal by the Central Government, the said controversy has to be adjudicated.

639.

On the basis of the aforesaid facts, it cannot be suggested that on account of mere deletion of paras 28(iv) and 28(v) by Goa from its complaint, this Tribunal has any restricted jurisdiction to adjudicate on the said aspect of the controversy.

640.

It would also be relevant to take note of the two communications dated 02.06.2010 and 09.04.2013, (Annexures 21 and Annexures 20, respectively) (Volume 38) whereby the

Central Government, while responding to the communications from the Government of Goa, had clearly maintained that the issue of deciding available utilizable water resources of Mahadayi

basin, its equitable distribution and extra basins diversion, including Kalasa-Bhanduri project, are still part of the complaint. Accordingly, on that basis also, the Tribunal finds that all the matters emerging from the water dispute between the parties are required to be adjudicated by this Tribunal, and deletion of any part of the complaint by Goa has no consequential effect upon the powers of this Tribunal.

641.

At this stage, it would be appropriate to notice that in para 2.24 of its Statement of Claims dated 02.01.2013, (Volume 10), Karnataka has referred to an inter-State meeting which was convened on 27.03.2002, under the aegis of the CWC, inter-alia, to consider the proposal of Karnataka for the clearance of Kalasa-Bhanduri projects. The minutes of the aforesaid meeting have been reproduced in the said paragraph. It would be appropriate to notice the relevant portion of the minutes of the Inter-State Meeting:

“3.0 Item No. 2: Hydrological studies for assessment of yield of the Madei/Mandovi river

....

....

....

Secretary (WR), Government of Karnataka highlighted the drinking water problems in Hubli-Dharwar towns where water supply situation had become precarious due to falling ground water level and supply had become possible only once in 10 days or so. He requested that clearance be given for diversion of 7.5 TMC from Madei to Malaprabha reservoir through Kalsa and Bhandurinala diversion schemes for supply drinking water to the twin towns. Secretary(WR), Government of Goa stated that requirements of the Madei basin should be first met before considering outside diversion. He referred to the Krishna Water Tribunal Award in this context, where certain restrictions had been placed by the Tribunal on Maharashtra for diversion of Krishna waters outside the basin. He was of the view that Karnataka should examine other options like diversions from Kali to meet the shortage in Maharashtra. Since drinking water was the first charge, Government of

Karnataka should curtail irrigation supplies at Malaprabha.

In response, Advisor, Government of Karnataka stated that they had examined all options and the only technically and economically feasible solution was diversion by gravity fr om Madei."

642.

The State of Karnataka has also annexed as Annexure 61, a report on "Drinking Water Demand of Hubli -Dharwad, En-route villages, etc., from Malaprabha reservoir" (Volume 16).

1194

Relevant portion of para 4 of the aforesaid report is extracted below:

“4. Comparison of Alternative Water Sources Apart from present Malaprabha Dam Source, there are more sources namely, Kali River near Dandeli, Tungabhadra Dam, Almatti Dam and Bedthinaala. A Comaprative assessment of all these five sources has been done to decide the most feasible sources for meeting drinking water requirement of Hubli- Dharwad (Table 4).”

643.

under:-

“Hence, among all the four s ources, Malaprabha dam source has the lowest capital cost, minimum power requirement, least expenditure on operation and Maintenance and lowest water tariff. Hence, it may be concluded that Malaprabha reservoir source is the most feasible source in all respects for meeting the drinking water demand of Hubli-Dharwad and surrounding towns/villages.”

644.

During the course of evidence, the State of Karnataka

In view of above, the State of Karnataka concluded as

has produced Shri G.M. Madegowda, as an expert witness, as

RW-4. The aforesaid witness had filed his affidavit dated

9.11.2017 (Volume 207), as his examination-in-chief. It would be

1195

appropriate to notice certain portion from the aforesaid affidavit of this witness:

“13. Malaprabha source was identified because of its proximity to Hubli-Dharwad and also because of availability of source storage and as per the instructions of Government. Water supply from Almatti dam, Super dam, Tungabhadra dam and Bedhti river are Techno-economically not feasible as revealed in the “Report on Drinking Water demand of Hubli-Dharwad, Enroute villages etc., from Malaprabha Reservoir” filed on 02.01.2013.”

645.

Further, the witness stated as follows:

“In conclusion, I submit that Hubli -Dharwad and en route villages and towns etc. require about 7.56 tmc of water by the end of 2044 AD. The State Government has improved the water supply infrastructure and at present the works undertaken would ensure supply of 5.20 tmcft of water on 24x7 basis if Malaprabha dam is augmented

by Mahadayi waters to the extent of 7.56 tmc. The diversion from Mahadayi is necessary to relieve the burden on the existing water of Malaprabha dam, which is required for meeting the requirements of command areas, etc.”

646.

It is, thus, apparent that the State of Karnataka, had a long standing dispute with the Goa with regard to aforesaid

Kalasa - Bhandura project, and the diversion of water from Mahadayi river basin to Malaprabha basin. In various inter-State meetings held between the two States, the issue was always taken up for resolution but has remained unresolved so far. It is further apparent that the witness of the State of Karnataka,RW-4, has himself stated that the aforesaid diversion from KalasaBhandura project was being adopted, as it was financially more viable. Therefore, at this stage, it cannot be suggested by the State of Karnataka that the State of Goa was in any manner precluded from raising the aforesaid controversy before this Tribunal for adjudication.

647.

It would also be beneficial to note, as already noticed above also, that before constitution of this Tribunal by the Central Government, Goa had filed an original suit before the Hon'ble Supreme Court of India. All the pleas, which had been raised in the complaint and which are a part of the Statement of Claims before us also, had been raised before the Apex Court as well. In those proceedings, the matter was being contested by the State Government of Karnataka. The prayer made by Goa before the Hon'ble Supreme Court was to direct the Central Government to constitute a Water Disputes Tribunal. During the

pendency of the proceedings before the Hon'ble Supreme Court, the Central Government issued a notification, whereby the present Mahadayi Water Disputes Tribunal was constituted, and accordingly the original suit filed by the State of Goa was disposed of by passing the order dated 20.01.2011. The detailed order passed by the Apex Court has already been extracted above, and even the operative portion thereof has been emphasized during the course of arguments by the learned senior counsel for Goa. It would be pertinent to notice the operative portion of the order, once again, for ready reference:

“Be that as it may be, since there has been request of the aforesaid three State Governments for referring the water dispute to the Tribunal, we take the aforesaid Notification on record whereby all the disputes regarding the inter-State River Mahadayi and the River Valley thereof are referred to the aforesaid Tribunal for adjudication and decision. In view of this order, all the issues, that have been raised in this suit, could be effectively raised before the aforesaid Tribunal in

accordance with law.

In view of the aforesaid order, nothing survives in this Original Suit, which stands disposed of accordingly. All the applications also pending, stand disposed of in view of this order.”

1198

648.

It is thus clear that the Hon'ble Supreme Court has directed that all the issues that had been raised in the suit by the parties could be effectively raised before the Tribunal. Accordingly, it does not now lie in the mouth of the State of Karnataka that the claim made by Goa, or any portion thereof, cannot be adjudicated by this Tribunal, or there is any other bar on the State of Goa in raising the said claim.

649.

In view of the aforesaid discussion, the Tribunal has no hesitation in holding that deletion of paras 28(iv) and 28(v) from the complaint dated 09.07.2002, vide letter dated 10.01.2007, addressed by Goa to the Secretary, Ministry of Water Resources, Government of India, does not in any manner bar the State of Goa from raising the objection to the diversion of water from Mahadayi River basin to Malaprabha reservoir.

650.

At this stage it would be appropriate to notice two issues framed by this Tribunal. Issue No. 39 and Issue No. 43(a)(i),

framed by the Tribunal are as under:

1199

ISSUE NO.39 :

“Whether the State of Karnataka establishes that the State of Karnataka is not in a position to meet its Hubli-Dharwad water supply requirements from locally available water resources as initially contended by the State of Goa and that there are no alternative sources available to the State of Karnataka from which the water supply needs of Hubli- Dharwad could be met.”

ISSUE NO. 43.a.(i) :

“Whether the State of Karnataka proves that out of its total claims of 24.15 tmc of consumptive use of water:

a. it is entitled to consumptive and/or diversion of 15.009 tmc of water to be drawn from flow of 75% dependability (i) through diversion of 7.56 tmc to provide drinking water to Hubli-Dharwad twin cities under the Kalasa- Bhanduranala Projects,”

651.

Intrinsic in the larger issue, namely, whether Karnataka is entitled to diversion of 7.56 tmc to provide drinking

water to Hubli-Dharwad cities under the KalasaBhanduranala Projects, is the issue, namely, whether the State of Karnataka is not in a position to provide drinking water to Hubli-Dharwad twin city from locally available water resources.

652.

The issue, whether the State of Karnataka proves that it is not in a position to provide drinking water to Hubli-Dharwad twin city, from locally available water resources, is in-built in the issue whether the State of Karnataka is entitled to divert water of 7.56 tmc to provide drinking water to Hubli-Dharwad twin city.

653.

As mentioned above, the State of Goa has asserted by firmly stating that the State of Karnataka is in a position to provide water drinking needs of Hubli-Dharwad from locally available water resources. Therefore, inspite of deletion of paragraph 28(iv) and 28(v) of its complaint dated 09.07.2002 vide letter dated 10.01.2007, addressed by the State of Goa, to the Secretary, Union Ministry of Water Resources, New Delhi, the Tribunal will have to decide the question, whether the State of Karnataka proves that it is not in a position to supply water for drinking to Hubli and Dharwad twin city, from locally available water resources.

654.

Thus, the Tribunal finds that deletion of paragraph 28(iv) and 28(v) of its complaint dated 09.07.2002, does not bar the State of Goa from urging before the Tribunal that the State of

1201

Karnataka is in a position to provide drinking water to Hubli and Dharwad twin city from locally available water resources.

655.

Issue No. 38 is, accordingly, decided against the State of Karnataka.

Findings on whether the CWC Report of March, 2003, is to be treated as Report of Central Water Commission

656.

One of the documents, Volume 15, which has been filed as Annexure-29, to its Statement of Claims, by the State of Karnataka on January 2, 2013, is titled as “Central Water Commission (CWC) Report of March, 2003” on the Yield Studies in Mahadayi Basin.

657.

The aforesaid document is a matter of major controversy between the three contesting States. Whereas the State of Karnataka, who has filed this document, has maintained that the aforesaid document is the Report of CWC of March, 2003 on the Yield Studies in Mahadayi Basin, the State of Goa has

vehemently contested the said factual position and has maintained that, in fact, the said document is not at all any Report of Central Water Commission, but is merely a study

prepared by some officials of the Central Water Commission, and there is absolutely nothing to suggest that either the said study was ever approved by CWC, checked by CWC or in any manner was authenticated by the CWC in any of the Commission's meetings. On that basis, the State of Goa, during the entire proceedings before the Tribunal, without referring to the said document as a CWC Report has merely referred to it as "So -called CWC Report". However, the State of Maharashtra has chosen to rely upon the said document and has also termed it as CWC Report of 2003. The expert witnesses of the three States, during their Examination-in-Chief, while preparing their respective studies/analysis, and during the course of their respective cross-examination by the opposite side, have also chosen to refer to the said document. While the witnesses Shri A. K. Gosain, RW-1 and Shri A. K. Bajaj, RW-2, appearing for the State of Karnataka, and Shri S. N. Huddar, MW-1, appearing for the State of Maharashtra, have strongly supported the said document as a CWC Report of the year 2003, and based their respective studies/report on the same, Shri ChetanPandit, AW-1, appearing

for the State of Goa, though has also repeatedly referred to the said document as CWC Report in his Affidavit dated 04.08.2016 (Volume 191), and at times has even supported the portions of

the said study, he has by and large, referred to the same as “so -called CWC Report,” during the course of his cross -examination.

658.

Since a serious doubt has arisen about the existence, authenticity and preparation of the said Report, by the CWC, and its consequential approval by the CWC in its official capacity, the said issue needs to be resolved by the Tribunal for appropriate adjudication of the matter, at the initial stage of the present Report.

659.

Section 9 of the Inter-State River Water Disputes Act, 1956, (Act) provides for the powers of a Water Disputes Tribunal, constituted under the Provisions of the Act. Section 9(1)(ba), lays down that the Tribunal shall have the powers for “requisitioning of any data as may be required by it.”

660.

In view of the serious controversy between the parties with regard to the said document in Volume 15, as noticed above, this Tribunal in exercise of its powers under Section

9(1)(ba), wrote a communication dated May 01, 2018 to the Chairman, CWC, New Delhi, seeking information with regard to the procedure generally followed by Central Water Commission

for conducting a technical study and preparation of Report, particularly a report on hydrological studies, whenever a State Government or a project authority requests CWC for such study/report; the present status of the said Report prepared by Hydrological Studies Organisation, Hydrology (South) Directorate of March, 2003 filed by State of Karnataka as Annexure-29 of its Statement of Claims; and whether the said Report titled “Stu dy on Yield of Mahadayi River Basin” has been approved or accepted by the competent authority, and if so, by which authority and when.

661.

It would be appropriate to extract below the aforesaid communication dated May 01, 2018 addressed by the Tribunal to the Chairman CWC as below:

“MAHADAYI WATER DISPUTES TRIBUNAL

MINISTRY OF WATER RESOURCES

River Development and Ganga Rejuvenation

GOVERNMENT OF INDIA

(Email: mwdt2011@gmail.com)

5th Floor, ‘A’ – Wing,

Janpath Bhawan, Janpath,

New Delhi – 110001 – Tel. No. 011-23329577

Dated: 1 st May, 2018

1205

The Chairman,

Central Water Commission,

Sewa Bhawan, R.K. Puram,

New Delhi-110066

Sir,

The State of Karnataka has filed a report titled “Study on Yield of Mahadayi River Basin” of March 2003 by the Hydrological Studies Organization, Hydrology (South) Directorate, as Annexure-29 of its Statement of Claims before this Tribunal. The said document is described as CWC (2003) Report. In this regard, it is pertinent to note that the State of Goa has claimed that there is no such CWC (2003) Report and has always described the said document as “ so called CWC(2003) Report ” .

In this regard, I am directed to seek following information from Central Water Commission at the earliest.

a.

What is the procedure generally followed by Central Water Commission for conducting a

technical study and preparation of Report, particularly a report on hydrological studies, whenever a State Government or a project authority requests CWC for the such study/report?

What is the present status of the said Report titled “Study on Yield of Mahadayi River Basin” by the Hydrological Studies Organization,

b.

1206

Hydrology (South) Directorate of March 2003 filed by the State of Karnataka as Annexure – 29 of its Statement of Claims?

c. Whether the above said Report titled “Study on Yield of Mahadayi River Basin” by the Hydrological Studies Organisation, Hydrology (South) Directorate of March 2003 filed by the State of Karnataka as Annexure-29 of its Statement of Claims, has been approved or accepted by the competent authority? If so, by which authority and when?

Please send the requisite information along with authenticated copies of relevant documents including Note-Sheets, at the earliest.

Yours faithfully,

Sd/-

(M.R. Kondle)

Registrar”

662.

Vide a communication No.7/Karn-49/91-Hyd (S)/111-112 dated May 02, 2018, the Director, CWC, with the approval of its Chairman, responded to the request made by the Tribunal and provided the requisite information, as sought by the Tribunal. Along with the aforesaid communication, the relevant note-sheets were also enclosed.

1207

663.

It would be relevant to extract the aforesaid communication, dated May 02, 2018, along with its enclosures, addressed by the Director, CWC, New Delhi, to the Registrar of this Tribunal, as follows:

“Government of India,

Central Water Commission,

Hydrology (South) Directorate

7th Floor (S), Sewa Bhawan,

R.K.Puram,New Delhi-110066

Phone/Fax 011-29583507

hydsouth@nic.in Email: hydsouth@nic.in

No.7/Karn-49/91-Hyd(S)/III-112 Dated:02.05.2018

To

The Registrar

Mahadayi Water Dispute Tribunal

MoWR, RD & GR, 5th Floor, A Wing,

Janpath Bhawan, Janpath, New Delhi-1100 01

Ref: Office of Chairman letter no. 1290 dated 01.05.2018

Sir,

With reference to above mentioned letter of Mahadayi Water Disputes Tribunal, the information available with CWC are as under:

Sr. No.	Information sought by Registrar	Material for Reply

A	What is the procedure generally followed by Central Water Commission for conducting a technical study and preparation of report, particularly a report on hydrological studies, whenever a State Government or a project authority requests CWC for the such study/report?	The cases are initiated by Assistant Director (AD) /Assistant Director-II (AD-II), checked by Deputy Director(DD), put up to Director, for finalization and thereafter approved by Chief Engineer(CE). In general majority of references/issues are disposed of at the level of Chief Engineer when no policy matter is involved. When policy matters are involved, approval of concerned Member/Chairman, CWC is obtained before disposal.
B	What is the present status of the report titled “Study on Yield of Mahadayi River Basin” by the Hydrological Studies Organisation, Hydrology (S) Directorate of March 2003 filed by the State of Karnataka as Annexure-29 of its Statement of Claims?	In the Interstate Meeting convened by the Hon’ble Minister for Water Resources th on 20 December 2002 with Chief Minister of Goa, Minister of Water Resources of Goa, Minister for Major and Medium Irrigation Projects, Government of Karnataka and other participants on Mahadayi/Mandovi/Madei Water Dispute, it was decided that CWC will carry out yield study of this Basin as per Standard Guidelines and procedures for confirming the

		water availability in association with the party States after reconciliation of data. The assessment of the yield was required to be completed by 31/3/2003. The discharge data of CWC site Ganjim were collected from published water year books of CWC and used in the study. The rainfall data was collected by CWC from IMD. The Govt. of Goa, Karnataka, Maharashtra and NWDA were requested to send their representatives for conducting the joint study. Karnataka and NWDA sent their representatives and fully associated themselves with the study. Maharashtra did not respond. Goa initially sent a representative but later withdrew him saying that they have to compare the rainfall data received from IMD by CWC with the rainfall data Goa received separately from IMD and also because they were not given access to the raw data of observations by CWC at Ganjim.

		The study report was drafted in CWC in March 2003 by the Group consisting of members NWDA and Government of Karnataka, wherein Goa did not participate.
C	Whether the above said report titled the “Study on Yield of Mahadayi River Basin” by the Hydrological Studies Organisation, Hydrology (S) Directorate of March 2003 filed by the State of Karnataka as Annexure-29 of its Statement of Claims has been approved or accepted by the Competent authority? If so, by which authority and when?	In pursuance to the decisions taken in the meeting dated th 20 Dec, 2002, the study report prepared by the group titled the “Study on Yield of Mahadayi Basin” was sent by Chairman, CWC to the Ministry of Water Resources through then Commissioner (RR). Though the report was prepared without the participation of Goa, which had some doubts on basic data also.

Further, as desired the authenticated copy of the report

titled “Study on Yield of Mandovi River Basin” and relevant note

sheets are enclosed.

This issues with the approval of Chairman, CWC.

Encl: As Stated Above.

Yours faithfully,

1211

Sd/-

(S.K.SINHA)

Director

Copy for information to:

Director, D&R (C), CWC”

ENCLOSURES (Note-Sheets):

“No.7/Karn -49/91-Hyd(S)

Central Water Commission

Office of Chief Engineer(HSO)

Subject: Yield Study of Mahadayi River Basin.

In the Interstate Meeting convened by the Hon’ble Minister for Water Resources on 20 th December 2002 with Chief Minister of Goa, Minister of Water Resources of Goa, Minister for Major and Medium Irrigation Projects, Government of Karnataka and other participants on Mahadayi/Mandovi/Madei water dispute it was decided that CWC will carry out yield study of this basin as per standard guidelines and procedures for confirming the water availability. The

assessment of the yield was required to be completed by 31.03.2003.

The basic problem in the assessment of water availability of Mahadayi basin was authentication of rainfall data to be used in the study. Since the rainfall data was collected independently by NWDA, Karnataka and Goa from different offices of IMD at different

times, reconciling these data became a bottleneck. Therefore after the Ministerial level meeting it was decided that CWC should independently obtain authenticated rainfall data directly from IMD, Pune for carrying out the study.

The discharge data of CWC site Ganjim were collected from the published Water Year Books of CWC and used in the study.

With the above basic data study on yield of Mahadayi basin was carried out during March 2003 and report finalised. The study report is placed below:

The yields worked out are as under:-

50% dependability yield

6234 Mcum

75% dependability yield

5652 Mcum

The Government of Goa, Karnataka and Maharashtra and NWDA were requested to send their representative for conducting the joint study.

Karnataka and NWDA sent their representatives and fully associated themselves with the study. Maharashtra did not respond. Goa initially sent a representative but later withdrew him saying that they have to compare the rainfall data received from IMD by CWC with the rainfall data Goa received separately from IMD and also because they were not given access to the raw data of observations by CWC at Ganjim. A copy of the rainfall data received by CWC from IMD was given to Goa.

1213

The practice of CWC is to supply only processed and published discharge data to the Users. Raw data is not supplied. In this connection a copy of letter dated 5.2.90 of MOWR is placed below restraining the supply of raw data. They are being informed that they may visit the site and go through the observational procedures of data collection and processing procedures. Chief Engineer, KGBO, Hyderabad inspected the Ganjim site recently and confirmed that the observations are being done satisfactorily. A copy of his report dated 26.3.2003 is at Annexure-IX of the Study Report.

Sd/-

(V.R. Sastry)

Chief Engineer(HSO)

Member (RM), CWC

For perusal please.

Sd/-

10.4.03

Chairman,CWC: Authenticated/Published discharge data of CWC site has been used. Rainfall data has been collected afresh from IMD. Representatives of NWDA, Karnataka & Goa Govts.were invited. While the first two co-operated in the study, Goa raised objections regarding both rainfall data of IMD and discharge data of CWC site, restraining any further study to be made by CWC for assessing water availability.

1214

Collection of data from different offices of IMD took time (about two months). But, the study was completed in due time.

Brief report of the yield study is sent herewith for perusal of Secretary (WR).

Sd/-

10/04/2003

Commissioner (PR), MoWR

SJC(BM) Sd/-

10/4

Subject: Yield studies of inter-State Mahadei River Basin.

Government of Goa has sent a complaint to Union Government in July 2002 to constitute a Tribunal to adjudicate the dispute on the inter-state river Mahadei. As per the provisions of the Inter-State River Dispute Act, 1956, a Tribunal is to be constituted within a year of the receipt of the complaint to adjudicate the river water disputes in case the

negotiations to resolve the dispute does not succeed. Minister of Water Resources had convened a meeting on bringing consensus by negotiations among the States of Goa, Karnataka and Maharashtra on the inter-State river water dispute on the sharing of waters of river Mahadei on the complaint filed by the State of Goa. During the meeting taken by the Minister of Water Resources, it was decided that the Government of Goa and CWC officials may make joint efforts to reconcile the discrepancies in the data and yield figures through a study carried out as per the standard

guidelines and procedures for confirming the water availability by March 2003.

The CWC along with the representative from Government of Karnataka and NDWA made joint study to work out the yield of the river. The Government of Maharashtra did not nominate any representative for the joint studies. The rainfall data collected by CWC from IMD and the discharge data of CWC at site Ganjim as published in the water year book of CWC were used in the study.

The yield of the river has been computed as follows by the joint studies:

50% dependability - 6234 MCUM

75% dependability yield - 5652 MCUM

The Government of Goa withdrew their representative from the joint study saying that the raw data of discharge observations at CWC site must be made available to them. The Government of Goa has been informed by the CWC that the raw data cannot

be supplied to them, however, they may visit the site and go through the observational procedure of data collection and processing procedure. It is, therefore, anticipated that though the negotiations efforts to resolve the Mahadei river water dispute may be fruitful but it will take considerable long time for which the CWC and the basin States have to proceed further to overcome the points of disagreement on the dependable yield of river Mahadei. This effort may take considerable long time and hence it may not be

possible for the Union Government to assume that the negotiation efforts have failed and the constitution of the Tribunal is the only available remedy to adjudicate the water dispute on the river Mahadei. The schedule time frame to constitute the Tribunal by July 2003 is, therefore, not practical and it will be appropriate that the Union Government requests the Government of Goa to withdraw their request for constitution of Tribunal so that full efforts can be made towards negotiating the dispute among the Government of Goa and Karnataka on the yield studies of river Mahadei. A letter addressed to Government of Goa requesting them to withdraw their complaint has been submitted separately for approval.

(M. S. GUPTA)

SJC (BM) / 17.04.03

Commissioner (PR)

CWC has completed yield studies of inter-State Mahadei River Basin. However, Goa still has some

doubts on basic data. CWC and Goa may have to continue further efforts for arriving at the accepted yield figures. This needs further time. Thus we may request Government of Goa to withdraw their earlier request of July 2002 for setting up a Tribunal. Efforts for arriving at yield figures mutually acceptable to the State may be continued. Draft letter to Goa Govt. requesting to withdraw their complaint has been put up earlier.

For kind information of Secy. (WR) pl.

1217

Sd/- 18/4

Secy (WR) :

Sd/- 21/4

C (PR) :

Sub: Yield study of Madei River Basin.

Reference notes on pre-page

In the Inter-State meeting convened by Minister of Water Resources on December 20, 2002, it was decided that Govt. of Goa and CWC may take joint efforts to reconcile with the discrepancies in the data and yield figures. In the meeting, Union Secretary (WR) stated that study may be carried out as per the standard guidelines and procedures confirming the water availability.

In April, 2003, Govt. of Goa has been requested to with-draw their request of July, 2002 regarding constitution of tribunal for adjudication of the Madei Water dispute with a view to find out negotiated settlement of dispute. The reply from Govt. of Goa is

awaited.

CWC in its note of 10.4.2003 has observed that Govt. of Goa are being informed that they may visit the site and go through the observational procedures of data collection and processing procedures in view of the restrictions placed by Ministry of Water

Resources for supplying of raw data, CWC, therefore, may proceed further in the matter and convince Goa Govt. about the data collection procedure followed by CWC at Ganjim Site. Further a meeting of the engineers of the two States may be called in CWC to reach an agreement on the studies done by CWC.

Sd/-

(R. K. Sharma)

Commissioner (PR)

Secretary (WR):

Sd/-

21/5/2003

Chairman (CWC)."

664.

The aforesaid correspondence between this Tribunal and the CWC, along with enclosures thereto, constitute Volume 242 of the record of this Tribunal.

665.

It would be pertinent to mention here that the

document (Volume 15), Annexure-29 alongwith its Statement of Claims, filed by the State of Karnataka as Central Water Commission Report (CWC) is shown to be of March, 2003,

whereas enclosures of the office note-sheets appended with the communication dated May 02, 2018 from the Director, CWC to this Tribunal, indicate that the matter was under constant discussion and processing even in the months of April and May, 2003, in as much as the State of Goa had originally taken certain objections, during the course of conducting joint study between the Governments of Goa, Karnataka, Maharashtra and NWDA, and later on when the State of Karnataka and NWDA had sent their representatives and associated themselves with the study, the State of Maharashtra did not respond and the State of Goa, initially sent a representative, but later withdrew him on account of certain differences.

Later on, the aforesaid matter was forwarded by Chief Engineer, H.S.O., to the Ministry of Water Resources of Government of India through appropriate channels. After consideration of the entire matter at the Ministry level, it was observed that since the scheduled time frame to constitute the Tribunal was up to July, 2003, which was not practical, at that point of time, therefore, it would be appropriate that the Union

Government requested the Government of Goa to withdraw their request for constitution of a Tribunal, “so that full efforts can be made towards negotiating the dispute among the

Government of Goa and Karnataka on the Yield Studies of river Mahadayi".

666.

The note-sheet, enclosed with the above said communication of CWC, addressed to this Tribunal, contains a noting of the Commissioner (PR), that "further a meeting of the Engineers of the two States may be called in CWC to reach an agreement on the studies done by CWC." The aforesaid noting seems to have been put up before the Secretary, Water Resources, who also had approved the same. The notings are dated May 20, 2003 and May 21, 2003, by the Commissioner (PR), and Secretary, WR respectively.

667.

It is, thus, clear that in the month of March, 2003, when the aforesaid Report is stated to have been prepared by CWC, there was no such Report ever having been finalized at the CWC level and, in fact, the matter was yet under consideration and discussion with the State Government of Goa. The notings on the file further show that the said study was merely conducted at

the Chief Engineer, H.S.O level.

1221

668.

Along with the document, stated to be CWC Report of 2003, (Volume 15), certain appendices have been attached, which are various Minutes of the Meetings of the Study Group on the Yield Studies of Mahadayi River Basin.

669.

Appendix 1 (Page 49 of Volume 15) indicates the presence of the representatives of all the three States, including the State of Goa. The discussion contained in the said Minutes reflects that their being a wide variation in rainfall across the basin, it was decided to consider all the stations, as was done in the preliminary study presented in the first Meeting.

670.

Appendix 3 is the Minutes of the second Inter State Meeting dated March 27, 2002 (page 54 of Volume 15), which was again attended by the representatives of all the three States. Item No. 2 thereof reflects that there were certain objections raised on behalf of the Government of Goa. In the light of the aforesaid objections, the Chairman of the Meeting, who was

Chief Engineer, H.S.O., asked Government of Goa to carry out the yield studies themselves. The relevant portion of the Minutes of the said Meeting is as under:

1222

“Chairman expressed his regret that Govt. of Goa has so many reservations on the yield studies and even on the data collected and utilized by an independent Expert agency viz., CWC. He indicated that if such doubts exist even in the work carried out by agencies like CWC perhaps the studies cannot progress. Chairman felt that under such circumstances, Govt. of Goa may themselves, carry out this yield studies. It was therefore decided that CWC and NWDA would supply all the hydrological and hydro-meteorological data collected and analyzed by them to Govt. of Goa for carrying out the yield studies. However, he emphasized that Govt. of Goa will have to stick to a reasonable time schedule. Secretary, Water Resources, Govt. of Goa stated that three months’ period is necessary for completing the yield study.”

671.

recorded:

Further, at page 57, the following Minutes were

“Chairman requested Govt. of Goa to finalize the yield studies for Mandovi basin at the earliest so that the developments in the basin is not hampered and water does not flow waste to the sea and impressed upon the basins States to frequently meet and exchange requisite information regarding the demands of the States so that water resources of the region could be utilized optimally by the basin States.”

1223

672.

A summary record of discussions of the Inter State Meeting convened by the Minister,(WR)on December 20, 2002 of representatives of the three States has also been appended in Volume 15 at pages 58-59. The relevant portion of the aforesaid summary is as below:

“After protracted discussions, it was decided that the Government of Goa and CWC officials may make joint efforts to reconcile the discrepancies in the data and yield figures. Union Secretary (WR) stated that the study may be carried out as per standard guide lines and procedures for confirming the water availability. The reconciliation process/assessment of the yield should be completed by March 31, 2002.”

673.

From a perusal of the aforesaid documents on the record, and the factual position submitted by the CWC through its communication dated May 2, 2018, addressed to this Tribunal, and the Note-sheets, appended thereto, leave no matter of

doubt that the Report contained in Volume 15 submitted as Annexure 29, by the State of Karnataka along with its Statement of Claims, is merely a Study Report prepared in the Meeting convened by the Chief Engineer, HSO, CWC and cannot be termed to be a Report of the CWC, which had ever been duly approved by it, in accordance with law. It is also clear from the

Note-sheets, forwarded by the CWC to the Tribunal that the matter was yet under consideration and discussion at the level of the CWC, as well as Water Resources Ministry of Government of India, in the months of April and May, 2003, respectively, and a proposal was put up on May 20, 2003 at the Ministry level that a Meeting of the Engineers of the two States (State of Goa and the State of Karnataka) may be called in CWC to reach to an agreement on the studies done by CWC.

674.

Thus, the Tribunal has no hesitation in holding that the aforesaid Report, Annexure 29 (Volume 15), cannot be said to be a Report of the CWC, but is merely a Study Report of Hydrological Study Organisation (HSO), a wing of the CWC, prepared jointly with the representatives of NWDA, State of Karnataka and with occasional participation

of

the

representatives of the States of Goa and Maharashtra.However, the Annexure 29 of the Statement of Claims of the State of Karnataka which is titled as Central Water Commission Report of March, 2003 (Volume 15) is, subsequently, examined by the Tribunal, in the alternative, from the view point of its technical contents without making any change in the title of the Document filed by the State of Karnataka.

1225

Determination of Dependability at which Water Availability is to be Assessed.

675.

By order dated 17.07.2015, this Tribunal has reframed voluminous issues, arising out of the pleadings of the parties, which are seventy in number. For the purpose of convenience, to record the findings and also to avoid the repetition of the factual findings, issues Nos. 7, 8, 33 & 53, relating to – as to whether the water availability assessment of the Inter-State River, Mahadayi, should be for 75% dependable flow or for 50% dependable flow or for average flow, at various points in the Mahadayi Basin and tha t at Karnataka's disputed Projects sites, are being dealt with together.

676.

The issues specified, supra, are as under:

"7. Whether the State of Goa proves that the water availability assessment of the Inter-State river Mahadayi should be for 75% dependable flow at various points in the basin and at Karnataka's disputed

project site?”

“8. Whether the water availability assessment of the inter-State river Mahadayi should be made for different dependabilities as suggested by the States?”

“33. Whether the State of Karnataka proves that the water availability assessment of the inter-State river Mahadayi should be for 75% dependable flow?”

“53. Whether the State of Maharashtra proves that water availability assessment should be made on the basis of total availability of water in the Mahadayi river basin?”

677.

It is needless to say that these issues are important issues and the findings in relation thereto would have impact while deciding the Equitable Distribution and the related aspects of the waters of Mahadayi Basin, between the State of Goa, the State of Karnataka and the State of Maharashtra.

678.

Voluminous evidence has been led in by the three party States, and it is sufficient to state that for the purpose of appreciating these crucial aspects, and to arrive at an appropriate decision, the relevant portions of the averments made in the Examination-in-Chief , Affidavits, the relevant answers given to

certain questions put in the cross-examination by the adverse State, certain answers given to questions put by the Tribunal as also the Reports and other relevant materials, available on the record, will have to be carefully analyzed and appreciated.

1227

679.

It may be mentioned that in its Complaint dated 09.07.2002, addressed by the Government of Goa to the Secretary, Union Ministry of water Resources, Government of India, New Delhi, the State of Goa has specifically stated that the availability of water should be determined at 75% dependability. It is so mentioned in paragraph 12.2 and paragraph 28.0(i) of the above said letter.

680.

The State of Karnataka initially mentioned in its letter of Complaint dated 22.06.2010, addressed to the Secretary to Government of India, Ministry of Water Resources, New Delhi, that the available water for allocation in the Inter-State River Mahadayi and its valley should be assessed at 50% dependability. In the pleadings, the State of Karnataka has indicated the water availability for the entire basin at 75% dependability as well as at 50% dependability. However, the Expert Witness Prof. A. K. Gosain, for the State of Karnataka has assessed the water availability at identified project sites at 75% dependability, 70%

dependability, 60% dependability and 50% dependability.

1228

681.

It is worth noticing that Shri ChetanPandit, Expert Witness of the State of Goa, in his Report of August, 2016 (Volume 191), and Report of January, 2017 (Volume 196), has estimated yields for the Mahadayi Basin, or for the various projects, at 75% dependability and 50% dependability. However, the Tribunal notices that specific justifications or reasons for assessing the yields at 75% dependability and 50% dependability, have not been mentioned in the two Reports, submitted by him.

682.

Prof. A.K. Gosain, Expert Witness of the State of Karnataka , in his Reports of September, 2015 (Volume 166) and May, 2017 (Volume 198 & 198A), has estimated yields for the Mahadayi Basin at 75% dependability and 50% dependability. Further, in his report of November, 2016 (Volume 193), Prof. A.K. Gosain has estimated the yields for the various identified projects sites at 75% dependability, 70% dependability, 60%

dependability and 50% dependability. What is worth noticing is that no specific justification or reasons for assessing the yields at 75% dependability, 70% dependability, 60% dependability and 50% dependability have been mentioned in his three Reports, submitted before the Tribunal.

1229

683.

Shri S.N. Huddar, Expert Witness of the State of Maharashtra, in his Report of September, 2015 [Volume 163(a)], has estimated the contribution to the Mandovi Basin from Maharash tra's portion in terms of Average Yield and Yield at 75% dependability. In this case also the Tribunal finds that no justifications or reasons, for assessing the Average Yield and the Yield at 75% dependability, have been assigned by Shri Huddar in his Report.

684.

The position in law, which emerges from the discussion of evidence of the three witnesses, mentioned here-in-above, is that neither the State of Goa, nor the State of Karnataka nor the State of Maharashtra have furnished justifications for assessing the Yield of Mahadayi Basin at 75% dependability or any other dependability and the State of Karnataka has failed to provide justifications for assessing water availability at dependability other than 75% for the Projects

located in the State of Karnataka .

685.

In

answer

to

question

No.

3

put

by

Shri

DattaprasadLawande, the learned Advocate General for the State

of Goa, pointed attention of witness ShriS.N. Huddar (MW1) was

drawn as to what he had said in paragraph 4.2 on page 19 of his Affidavit dated 13th September, 2015, and a specific question, namely, question No. 3(q) was put to the witness, as to whether, itwas checked by the Witness or his team as to what was the determination of 75% dependable yield from the runoff series.

686.

The answer given by the witness was that the results are mentioned at the end of proforma (c) to his study at page 41. If one refers to page 41 of his testimony, it is found that no reasons are assigned by the Witness as to why the availability of water was assessed by him at 75% dependability.

687.

Further, question No. 4, put to the witness by the learned cross-examiner, on behalf of the State of Goa, was that is there anything in the so-called CWC(2003) Report (Volume 15), that he disagree with, if yes, he was requested to outline each of the points of disagreement.

688.

The answer given by the Witness was that he had not

scrutinized CWC(2003) Report (Volume 15) in details and the only thing he had looked in this Report was the estimated yield of

1231

5652 Mcum at 75% dependability and had considered that it was a reasonable estimate.

689.

Thus, this witness has failed to give any cogent reasons as to why the availability of water should be calculated at 75% dependability.

690.

In reply to question No. 40 put to him by the Tribunal on 17.07.2017, inquiring as to why the yield at ten sites was estimated for 60% dependability and 70% dependability, in addition to 50% and 75% dependability, and what was the utility of estimated yield at 60% dependability and 70% dependability for the ten Sites, Prof. A.K. Gosain (RW1), had given the following answer:

“While estimating the yields for various projects, the dependability computations were also made for other values beyond 50% and 75%, such as 60% and 70%, since the worked yields of these projects by the respective organisations were available, and I was

trying to find out by how much per cent of dependability the various computed yields by different Departments, will be different from the present value. For example, on page 4 of my November, 2016 Report, it has been mentioned that “the yield at Bhandura dam is estimated by me as 3.7 tmc at 75% dependability,

1232

whereas the yield is estimated as 4.0 tmc at 75% dependability in the detailed project report of 2000(Vol. No. 20). If the yield is 4.0 tmc, the project will operate at 70% dependability". Therefore, the idea was to bring in more clarity in the results."

691.

The Tribunal further finds that in its Statement of Claims, as well as in Paragraph 11.1(a) of the amended Statement of claims, filed by the State of Karnataka had suggested that water availability in Mahadayi Basin should be assessed at 50% dependability and, accordingly, as per the order dated 21.08.2013 of the Tribunal, issue No. 16 was framed for determination as under:

"16. Whether the State of Karnataka proves that the water availability assessment of the inter-State river Mahadayi should be 50% of the dependable flo w?"

692.

However, the State of Karnataka, vide its letter dated 02.07.2015 (Volume 152), requested for revision of the said Issue

and ultimately the said Issue was reframed by order of the Tribunal dated 17.07.2015 (issue No. 33), as under:

“33. Whether the State of Karnataka proves that the water availability assessment of the inter-State river Mahadayi should be for 75% dependable flow?”

1233

693.

The State of Maharashtra has suggested the estimation of Average Yield of the Basin also in addition to the Yield at 75% dependability.

694.

The learned Assessors of the Tribunal have brought to the notice of the Tribunal - Regional Course on Project Hydrology, course material published by the National Institute of Hydrology, Roorkee.

695.

On reading “INTRODUCTION” of Chapter -IV: WATER AVAILABILITY ANALYSIS – of the published course material by the National Institute of Hydrology, Roorkee, it becomes evident that in order to ensure the success of a project, it is necessary to plan it as such that desired quantity of water is available on most of the time. It is empathetically stated therein that in India, the normal practice is to plan an irrigation project with 75% dependable flows. On the other hand, the hydropower and drinking water supply schemes are planned for 90% and 100%

dependable flows, respectively. The brief guidelines regarding minimum length of data required for some of the projects are given below:

1234

(a)

(b)

(c)

(d)

Minimum length

ofdata

Diversion project 10 years

Within the year storage project 25 years

Over the year storage project 40 years

Complex system involving Depending upon

combination of above the pre-dominent

element

It is not in dispute that Krishna Water Disputes

Type of project

696.

Tribunal-I (KWDT-I), constituted in the year 1969, determined the water availability at 75% dependability for the apportionment amongst the contesting parties.

697.

Likewise, in final order and decision of the Narmada Water Disputes Tribunal (NWDT), constituted in 1969, in clause II – Determination Of The Utilisable Quantum Of Narmada Waters, it is stated as follows:

“AtSardarSarovar Dam Site. The Tribunal hereby determines that the utilizable quantum of waters of the Narmada at SardarSarovar Dam Site on the basis of 75 per cent dependability should be assessed at 28 Million acre Feet (34.537.44 M.cu.m.)”

1235

698.

Similarly, in “Further Report and The Report of The Godavari Water Disputes Tribunal (GWDT), in paragraph 97, it is stated as under:

“It was agreed that Orissa will ensure at its border with Madhya Pradesh a flow of 45 TMC. in the Indravathi and its tributaries at 75 per cent dependability for use by Madhya Pradesh.”

699.

It is further stated that:

“Both the States agree to joint gauging at suitable points to ascertain the yield data and to ensure the flow of 45tmc at 75 per cent dependability or the proportionately reduced flow in years of shortage that has to flow below the common border.”

700.

Thus, GWDT also adopted 75% dependability for the purpose of assessing yield of river Godavari.

701.

In the Argument Notes by the State of Maharashtra,

filed before the Tribunal on 15.01.2018, at page 9,it is stated as

follows:

“DEPENDABILITY CRITERIA FOR DISTRIBUTION OF

MAHADAYI BASIN YIELD:

a) The practice of basin planning of water resources development projects on water availability as per 75% dependability is in vogue all over the country. At the time of implementation of the Second Five Year Plan, Shri Hardikar, the then Chief Engineer of old Hyderabad State, insisted the Planning Commission, to recommend 75% dependability criteria. The Central Water Commission upholds this suggestion. On 31 st March 1963, the Union Minister for Irrigation & Power had made the following statement in the Lok Sabha (Parliament) in connection with water allocation of Krishna & Godavari.

“In the matter of availability of supplies from overall consideration, a criterion based on 75% dependability has been considered to be most suitable and for the purpose of our project that have to go forward, this criterion of dependability may

be adopted.”

b)In pursuance of the recommendation of the Administrative Reforms Commission, the Union Council of Cabinet Ministers had constituted one sub-group in 1973. The sub-group recommended relaxation of this criterion to 50% dependability in case of drought prone area. Considering all the pros and cons, the Agriculture and Irrigation Ministry and the Planning Commission came out with a suggestion of adopting 75%, 60% & 50% dependability criteria in case of major, medium and

minor projects respectively in drought prone area. A Latitude of relaxing this criteria to 50% for the medium projects of deficit basis was granted.

c) The Maharashtra Water and Irrigation Commission (Exhibit MAH-6) has observed that a need has arisen to undertake a review of the logic behind the 75% dependability criterion. The veracity of the dependability is to be carried out in the light of criteria of scientific sanctity, tenability and economic stability. These criteria do not lead any basis to the 75% dependability. Statistically an average measure will be scientific in case of variables of varying scatter. It will not be an ad hoc figure like that of 75% dependable quantity. The Krishna Water Disputes Tribunal-I, headed by Justice Bachawat has observed that the average flows in the river basin are the maximum utilizable flows. The Cauvery Water Disputes Tribunal has also studied this aspect and permitted 50%

dependability flows to be utilized in the Cauvery Basin. The KWDT-II headed by Justice Brijesh Kumar, recently has permitted utilization of the average flows in the Krishna Basin.

d) The State of Maharashtra submits that it would be more appropriate to distribute the water available only at 75 % dependable flow, as this Hon'ble Tribunal would be distributing the yield for the first time."

1238

702.

The above said paragraph makes it more than clear that the State of Maharashtra has given up its case regarding assessment of water on the basis of average yield and has specifically stated that the yield should be estimated at 75% dependability.

703.

However, in the case of Ravi Beas, an average flow was used for apportionment. The KWDT, constituted in 1990, adopted 75% dependability for the purpose of assessment of water availability and the same was used for apportionment amongst the party-States. KWDT-II has made apportionment of average water availability, water availability at 65% dependability and water availability at 75% dependability among the party-States.

704.

Volume II of the Report of the CWDT, included a complete Chapter, namely, Chapter 2 on “What should be the basis on which the availability of water be determined for

apportionment – whether at 50% or 75%”.

705.

The background for the need to determine the dependability, at which yield should be estimated for

apportionment, has been discussed in paragraph 6 at pages 82-83, Volume II of the Report of CWDT and the same is reproduced as under:

"6. Before we examine this aspect of the matter as to whether the total yield of river Cauvery should be calculated at 50% dependability or 75% dependability, a special note has to be taken that in none of the disputes relating to sharing of the waters of any particular river in India in respect of which Tribunals have been constituted, there was so much of shortage and scarcity of the total yield of water in those rivers. Cauvery as already observed earlier is a river of blessing for the States including Union Territory of Pondicherry through which it passes before merging in the sea. But because of the very low total yield in comparison to other rivers in India at times it has proved to be a river of sorrow and has led to disputes for sharing of the water of the said river between the different riparian States specially between the States

of Mysore/Karnataka and Madras/Tamil Nadu. The dispute is going on for more than 150 years, details whereof have already been given in earlier volume of the report. The first agreement in respect of Cauvery was entered into between States of Mysore and Madras after correspondence between the two States for several years, in the year 1892 referred to above. Then another agreement about sharing of the water of the said river Cauvery and its tributaries was entered into in the year 1924. That agreement is to be reviewed and re-examined for purpose of fresh

allocation of water between the different riparian States in terms thereof. In this background, it has to be determined as to what is the dependable percentage 50% or 75%. It has also to be borne in mind that Tamil Nadu being a lower riparian State is naturally interested in assuring the dependability at 75%."

706.

In para 22 at page 93, Volume II of the Report, the CWDT it is further stated as under:

"…. As the disputes whether the dependability should be fixed at 75% or 50% was settled by an agreement with the aforesaid cases pending before the Krishna Water Disputes Tribunal, Narmada Water Disputes Tribunal and Godavari Water Disputes Tribunal, it can hardly be used as precedents for determination of that question when the party States are not agreeing."

707.

Similarly, the matter relating to choice of average water availability, has been discussed in detail in Report of KWDT

II, particularly at pager 305 to 330. While finalizing the choice of dependability for assessment of yield, KWDT-II has explained the concept of dependability at page 306 of the Report as under:

“The ‘percentage of dependability’ is relationship between volume of water available for utilization and the period of time in number of years during which it shall be available. Higher the dependability, lower the

quantity of available water for use and lower the dependability higher the quantity of available water. Obviously, assured higher quantity of water will be available for lesser number of years and vice versa".

708.

The KWDT-II had found that there was increase in the water availability over time and the utilization had gone much higher due to several factors. However, the KWDT-II observed that mere increase in water availability or utilization should not be the sole criteria for adoption of a specific dependability. At pages 321-322 of its report of 2010, KWDT-II stated as under:

"But at the same time, it does not mean that automatically utilization may be switched over to 50% dependability or on the average yield as suggested by Maharashtra and Karnataka i.e. distribution at about 2577 or 2600 TMC or any amount of water around that figure. Availability of more water alone is not the sole criteria for distribution and utilization of the water, rather all of it. The other factors to be considered are

the need of requirement, the capacity as may have been built store water as there is need of fairly continuous supply of water for utilization for different purposes.

Further to have some carry over storage capacity to meet at least minimum requirement in deficit or dry years, the users of water must have some confidence of getting certain amount of water for certain

percentage of period of time in number of years. So the dependability factor is very important in deciding how much of the available water may be utilized. Distribution at 50% dependability or an average implies 2 bad years out of 4 years. It must therefore have a good back up of carryover storage to take care of 50% of bad years."

709.

The argument in favour of adoption of 65% dependability are at pages 328 to 330 of their Report as under.

"We find that in the series of 47 years prepared in this Tribunal from 1961-62 to 2007-08, the yield at 65% dependability comes to 2293 TMC. This is a figure which is nearest to the utilization figure 2313.06 TMC in 2006-07. The figures of storage and the utilization which are found as fact are almost matching each other. In such a situation, we find it would be appropriate to distribute the water of river Krishna amongst the three States at 65% dependability. It

would mean that out of 100 years 2293 TMC atleast or more would be available in 65 years which will be around, though not exactly, but nearly two years out of three years in place of the availability at 75% in 3 years out of 4 years. But this change which is being made i.e. dependability at 65% will not be resulting in any drastic change. It would be certainly manageable. The distribution of this amount of water and the manner in which it may be utilized may take care of the some difference which may occur due to change in dependability factor. By fixing the said dependability

factor it will also check some wastage of water which has been going waste unutilized in 75% of the years at 75% dependability. The KWDT-1 has also observed as well as the Irrigation Commission that an effort is to be made to utilize as much water as possible. It has become more relevant in the present scenario when an acute scarcity of water is being felt all around, the wastage as far as possible must be checked and steps should be taken by the users of the water to minimize the wastage and maximize the utilization of water, also by adopting new methods of irrigation. Now some water may go waste unutilized in 65 years in place of 75 years out of 100 years but a substantial quantity of more water shall also be put to use. The dependability factor has been reduced only by 10%. The plea of Maharashtra and Karnataka to further lower the dependability to 50% or on average will not be feasible without any more carryover storages added to the existing ones. Thus, there is a good reason fix

dependability factor at 65%. The second limb of issue No.2 is answered in the manne r indicated above."

710. However, it is observed that after detailed examination of the claims of the Party States, KWDT-II also allocated quantum of surplus yield i.e., the difference between the average yield and the yield at 65% dependability for specific projects of Party States. The Clause-I to Clause-VI of the Order of KWDT-II, which specifies the allocation of water at different dependability is reproduced hereunder:

1244

“ O R D E R

Clause-I

In view and on the basis of the discussions held and the findings recorded on the issues hereinbefore, the following order is passed in so far as it deviates from, modifies, amends and reviews the decision and the order passed by the KWDT-1.

Clause-II

That for the purposes of this case, so as to assess the yearly yield of the river Krishna afresh, on the data now available, an yearly water series for 47 years has been prepared, accordingly the dependable yield is determined as follows :-

(a) Average yield - 2578 TMC

(b) Yield at 50% dependability - 2626 TMC

(c) Yield at 60% dependability - 2528 TMC

(d) Yield at 65% dependability - 2293 TMC

(e) Yield at 75% dependability - 2173 TMC

Clause-III

That it is decided that the water of river Krishna be distributed amongst the three States of Maharashtra, Karnataka and Andhra Pradesh on 65% dependability of the new series of 47 years i.e. 2293 TMC.

1245

Clause-IV

That it is decided that the allocations already made by KWDT-1 at 75% dependability which was determined as 2060 TMC on the basis of old series of 78 years plus return flows, assessed as 70 TMC in all totalling to 2130 TMC, be maintained and shall not be disturbed.

Clause-V

That it is hereby determined that the remaining distributable flows at 65% dependability, over and above 2130 TMC (already distributed), is 163 TMC (2293 TMC minus 2130 TMC = 163 TMC).

Clause-VI

That it is hereby decided that the surplus flows which is determined as 285 TMC (2578 TMC minus 2293 TMC = 285 TMC) be also distributed amongst the three States."

711.

From both the Reports it is apparent that choice of average yield or yield at 50% dependability or yield at 65%

dependability , in addition to the yield at 75% dependability for the purpose of assessment and apportionment thereof was made in view of the existing utilization level being more than the yield at 75% dependability.

712. The Tribunal finds that in case of Mahadayi Basin, the level of existing utilization is relatively very low.

713. Further, the State of Goa, the State of Karnataka and the State of Maharashtra have suggested the assessment of yield at 75% dependability. The Tribunal further finds that the major task, in process of assessment of yield, is to arrive at the time series of annual yield. The assessment of average yield or yield at 50% dependability or yield at 75% dependability or yield at any other value of dependability, is relatively a very simple process. The adoption of a specific value, either average yield or yield at 50% dependability or yield at 75% dependability, would be crucial for apportionment of the waters amongst the party-States and the process of apportionment would require consideration of several factors, particularly the existing level of utilization, committed water use and proposed projects – not only in terms of quantum of water but also in terms of priority of such uses, and reliability and degree of success of related projects.

714.

In view of what is stated above, the Tribunal considers it appropriate to finalise a series of annual yield for the Basin as a

whole and also in respect of specified locations/ project sites and compute the values of corresponding yield at 75% dependability, to be adopted for assessment of water availability of Mahadayi Basin and examining the claims of the three contesting States.

715.

As far as environmental flow is concerned, the Tribunal finds that on page 48 of “Standard Terms of Reference (TOR) for EIA/ EMP Report for Projects/ Activities Requiring Environmental Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change, published in April, 2015, there is a specific mention about environmental flow release as under:

“ – Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the committee based on the hydrology and available discharge.

- A site specific study on minimum environmental

flow should be carried out.”

716.

It may be mentioned that the above

stated

Notification of 2006 was brought on the record of the case as

“MARK 37” during the cross -examination of Shri Rajendra P.

Kerkar, who was examined on behalf of the State of Goa. In question No. 5, specific attention of the witness was drawn to the Notification of 2006 and a question was asked to him, as to why he had not considered the above-mentioned guidelines included in the “Standard Terms of Reference (TOR) for EIA/ EMP Report for Projects/ Activities Requiring Environmental Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change.

717.

The answer given by the witness was that he was not aware about the guidelines mentioned in the document “MARK - 37” and, therefore, he ha s no comments to offer.

718.

In view of what is laid down in the Notification of 2006, this Tribunal comes to the conclusion that environmental flow release should be 20% of the average of the four lean months of 90% dependable year during the lean season and 30% of monsoon flow during monsoon season.

719.

answered.

The issues Nos. 7, 8, 33 and 53, accordingly, stand

1249

Decisions relating to Mandatory Requirements for Project Implementation

720.

It has been maintained by the State of Goa that Mahadayi River flows through Wildlife Sanctuaries and sustains forest and wildlife and also National Parks in the State of Goa, and in the year 1999, part of Mhadei basin has been declared as Mhadei Wildlife Sanctuary under the provisions of Wildlife Protection Act, 1972. It has further been pleaded that the entire area of 208 sq. kms. ofMhadei Wildlife Sanctuary falls within the Mahadayi Basin. Goa maintains that river Mahadayi is the only river which flows through the entire territory of Mhadei Wildlife Sanctuary, as well as the BhagwanMahaveer National Park and Wildlife Sanctuary and the Bondla Wildlife Sanctuary. On that basis, it has been maintained that the action of the State of Karnataka, and that of the State of Maharashtra, in diverting the Mahadayi river water would not only be in contravention of the Doctrine of Public Trust but also in violation of the provisions of the Wildlife Protection Act. According to Goa, the entire project

has been started by the State of Karnataka without any permission from any of the Statutory Authorities, including the Authorities under the Environment Protection Act, Wildlife Protection Act, Forest Act etc. and, therefore, the aforesaid

action of the State of Karnataka is in utter violation and complete disregard of the provisions of the said Act.

721.

The aforesaid plea raised by State of Goa has been contested by the State of Karnataka. Though the pleas of any loss and damage or any type of injury to the State of Goa are denied but it has not been specified in the pleadings as to whether any type of approval or clearances are required for the aforesaid diversion, which is being proposed by the State of Karnataka or have been obtained.

722.

Even the State of Maharashtra in its entire pleadings has not specified that it has also obtained any approvals or clearances, as are required under the provisions of various enactments.

723.

On the basis of the aforesaid rival pleas raised by the contesting parties, the following two issues, being Issue No.2 and Issue No. 31, arising for consideration, are extracted below:

Issue No.2:

“Whether the State of Goa proves that as the river Mahadayi flows through three sanctuaries, the State

1251

of Karnataka and the State of Maharashtra require prior clearance of NBWL in addition to all statutory and other clearances?"

Issue No. 31:

"Whether the State of Goa proves that the various projects proposed and or undertaken by the State of Karnataka and Maharashtra require prior permissions under the Environment Protection Act, Forest Conservation Act, Wildlife Protection Act, Investment Clearance from Planning Commission, Permissions from the Central Government, National Board of Wildlife and other necessary permissions?"

724.

For the determination of the aforesaid controversy between the parties, it would be appropriate to notice the relevant pleadings of the respective States in this regard.

725.

In

the

amended

Statement

of

Claims

dated

23.04.2015 (Volume 131), the relevant pleadings of the State of Goa may be noticed as below:

“21. The Mahadayi River Water sustain forest and wildlife in Wildlife Sanctuaries and National Parks in the State of Goa, like Mahadayi Wildlife Sanctuary in SattariTaluka; BhagwanMahavir Wildlife Sanctuary in Mollem, SanguemTaluka; and Bondla Wildlife Sanctuary. Any reduction in the Mahadayi waters will

not only decimate the areas covered by Wildlife Sanctuaries and national parks admeasuring about 448.5 sq. km., but further will result in decimating the surrounding forests, particularly within the State of Karnataka since the whole belt is one contiguous belt of forests and wilderness."

" 21A. State of Goa submits that the proposed diversion scheme of the State of Karnataka will cause severe and irreparable damage and loss to the forests, wildlife and other organic life in the Mhadei basin particularly in the upstream areas. Goa submits that it is pertinent to note that in the year 1999 part of the Mhadei basin has been declared as Mhadei wildlife sanctuary under the provisions of the Wildlife Protection Act, 1972. The entire area of 208 sq. kms.of the Mhadei Wildlife Sanctuary falls within the Mhadei basin. This is also part of the Western Ghats which are internationally recognised as a region of immense global importance for the conservation of bio diversity.

The said region contains areas of high zoological cultural, and aesthetic values and has in fact been notified as one of the bio diversity hot spot. Besides the aforesaid , the water of river Mhadei sustains the forest and wildlife in various other Wildlife Sanctuaries and National Parks in the State of Goa, namely, the BhagwanMahaveer Wildlife Sanctuary in Molem; Bondla Wildlife Sanctuary in PondaTaluka; and Dr. Salim Ali Bird Sanctuary in TiswadiTaluka. It is pertinent to note herein that River Mhadei is the only river which flows through the entire territory of the Mhadei Wildlife Sanctuary as well as the BhagwanMahaveer

National Park and Wildlife Sanctuary and the Bondla Wild Life Sanctuary."

"190C(xxii). The action of the State of Karnataka and State of Maharashtra would be not only be in contravention of the Doctrine of Public Trust, but also in violation of Wildlife Protection Act. In terms of Section 29 of the Wildlife Protection Act, no person shall destroy any wildlife or destroy or damage the habitat of wildlife by any act or divert, stop or enhance the flow of water from the Sanctuary without the permission of the Chief Wildlife Warden. And such permission cannot be granted without the consultation of the State Government and the Board for better management of the wildlife."

"190C(xxiii). In the instant case, the provisions o f Section 29 of the Wildlife Protection Act are directly attracted. The State of Karnataka is trying to divert the water flowing into the Mhadei Wildlife Sanctuary. The same is being done without any permission from the

Chief Wildlife Warden, without the consultation with the National Board of Wild Life (NBWL) and to the satisfaction of the State Government of Goa. Such permission can be granted only for the improvement and betterment of wildlife. The entire activity proposed and part of it being carried out by the State of Karnataka is therefore illegal and in breach of not only the Wildlife Protection Act but also the Environment Protection Act."

"224 -I. There is complete breach of Article 14 of the Constitution of India. The manner in which the State of

1254

Karnataka has acted and conducted itself shows complete disregard to the Rule of Law which is a facet of Article 14 of the Constitution of India. The entire project has been started by the State of Karnataka without any permission from any of the statutory authorities including authorities under the Environment Protection Act, Wildlife Protection Act, Forest Act etc. The untoward hurry and haste which the State of Karnataka has shown in commencing the work at the site without any study and impact on the environment, ecology and people in the Mhadei basin itself shows highhandedness, arbitrariness and unreasonableness. This is in gross violation Article 14 of the Constitution of India."

726.

In reply, the State of Karnataka has denied, though not at all specifically, the aforesaid pleadings of the State of Goa. It would be appropriate to notice the relevant portion of the corresponding paras of the amended reply (Volume 138) dated

25.5.2015, filed by the State of Karnataka.

“5.23 In Re: Para 21 – The contents of Paragraph 21 are denied. It is denied that – “any reduction in the Mahadayi waters will not only decimate the areas covered by Wildlife Sanctuaries and national parks admeasuring about 448.5 sq. km., but further will result in decimating the surrounding forests, particularly within the State of Karnataka since the whole belt is one contiguous belt of forests and wilderness.” As alleged, diversion of water from river

channels or river course as planned by Karnataka does not affect the forest and wildlife. Karnataka submits that the forests are sustained by taking advantage of the water in the catchment. It is only that water, which is not absorbed by the vegetation in the forest that trickles down and contributes to the flows in the stream and river channels. Even the wildlife exists and survives mainly on water in the catchment. Karnataka submits that the MHEP project planned by it would improve summer flows in the river in the downstream reaches- which paragraph 21 does not take into account. Even in the upstream reaches, the back water in the storage dams would provide respite to the wildlife during summer. Karnataka therefore submits that the projects planned by it would advance the growth of forest and wildlife.

5.24 In Re: Paras 21 A, 21 B and 21C: Karnataka does not admit the contents of these paras. There is no nexus between the river flows in Surla and the

moisture content of the region. The averment that "the Kalasa River enters Goa as Surla River flows as huge wa ter fall" is misleading. There is no nexus between the river flows in SurlaNala and moisture content of the region. The Mahadayi Wildlife Sanctuary is unaffected by the diversion of flows in Karnataka. The catchment of Karnataka in Surla sub basin (KalasaNala is a tributary of Surla River) is 27 sq. km. The yield above Kalasa Dam for catchment area of 15.5 sq. km, based on Inglis formula, was 2.156 tmc (page 10, of K-II/C-3(g)). On this basis, the yield of 27 sq.kms of catchment would work out as 3.75 tmc at 75% dependability. The State of Karnataka will be using

3.56 tmc (including diversion from Surla to Kalasa Dam). The balance of 0.19 tmc will be flowing down to Goa in Surla River which is sufficient for maintaining minimum flows in the river below Kalasa Dam. Karnataka further submits that the SurlaNala is gauged for 9 years (1991-92 to 1999-2000) and Kalasa is gauged for 7 years (1991-92 to 1997-98). The catchment areas at gauge sites are 6 sq. km and 9.8 Sq.km respectively. The average gauged flow is 2.176 tmc at Surla gauge site and by applying a factor 0.85 the 75% dependable yield would be 1.85 tmc. Similarly the average yield of 3.047 tmc at KalsaNala gauge site will be 2.59 tmc by applying a factor 0.85. This factor of 0.85 is derived from 75% dependable yield of 44.15 tmc divided by yield of 51.93 tmc in the State of Karnataka [(Annexure-57 (colly.) at page 240, of document K-II/C-3(a)]. The catchment area up to Kalasa Dam is 15.5 Sq. km and on the basis of catchment area proportion the average flow up to

Kalasa Dam will be 4.1 tmc at 75% dependability. The total 75% dependable yield of SurlaNala and up to KalasaNala will be 5.95 tmc (1.85 + 4.1). Deducting 3.56 tmc proposed to be used by Karnataka the balance would be 2.39 tmc flowing down to Goa which is sufficient to meet the ecological, flora and fauna requirements.

Karnataka submits that after the construction of Kalasa Dam as per Kalasa DPR 2010, about 0.15 tmc of water would be maintained as downstream flows during the non-monsoon months from December-May at the rate of 10 cusecs per day. At present there are

no flows in the river (pre-construction flows) during the months of January to May as measured by Karnataka Kalasa inter-connecting canal for the water years 1991-92 to 1997-98. The flow tables of the Guage reading records and yield calculation for KalasaNala, HaltaraNala and SurlaNala are hereto marked and annexed as Annexure R-4 at pages 85 to 89. Therefore, the proposal of Karnataka to maintain 10 cusecs per day, which equals to 0.15 tmc at the border during the non-monsoon months would take care of and promote ecology."

"5.155D In re: Paras 190C(vi) to 190C(xxiv): In response to paras 190C (vi) to 190C (xxiv), the State of Karnataka submits that the contents are vague and general without any material particulars. The State of Karnataka denies that its proposed diversions of flows of Mahadayi River would affect flora and fauna Mahadayi catchment. There is no nexus between the flows in the river and requirement of water for flora

and fauna in the catchment. The flows in the river are the net result of the rainfall after accounting utilizations for flora and fauna. In these circumstances, the entire contentions of the State of Goa are misconceived and liable to be rejected."

"5. 190D In re: Paras 224(I) to 224(P): In response to paras 224(I) to 224(P), the State of Karnataka denies the correctness of the legal submission made by the State of Goa in these paras. The State of Karnataka reserves its right to make appropriate submissions on the legal submissions of Goa. The rest of the contentions are denied. There is no law which

necessitates that the upstream States shall obtain the consent of the downstream States for construction of any project. It amounts to bestowing veto power on the downstream State of Goa. In the Judgment of Supreme Court in the matter of O. S. No. 2 of 1997, it has been held by the Constitution Bench that "…… though it may be fully desirable for all the States to know about the developments of the other States but, neither the law on the subject requires that a State even for utilization of its own water resources would take the consent of other riparian States in case of an inter- State river."

727.

The Tribunal has also perused the reply filed by the State of Maharashtra (Volume 68) to the amended Statement of Case of Goa. The corresponding paragraphs of the aforesaid reply may be extracted below:

"7 With reference to paragraphs 21 to 49, 21A to 21H, and 25A to 25E the averments made therein are

denied. The State of Goa is put to strict proof of the statements made therein. It is denied that any reduction in the Mahadayi Waters would not only decimate the areas covered by Wildlife Sanctuaries and National Parks admeasuring about 448.5 Sq. Km., but would further result in decimating the surrounding forests. It is denied that Mandovi/Mahadayi River is the virtual lifeline for the entire State of Goa. It is further denied that steps taken by Maharashtra to utilise the waters of Mahadayi River would destroy,

choke, ruin or endanger the sustenance of river and prejudicially affect the State of Goa and its inhabitants by reducing the fresh water flows into the river and basin. It is denied that Mahadayi River/Basin is already a water deficit basin as per the Master Plan prepared by the panel of experts or otherwise."

"23. With reference to paragraphs 190A to 190C it is submitted that Goa is making belated attempts to inflate its needs for water from Mahadayi basin from those projected by the Panel of Experts in 1999. The State of Goa should not be allowed to make any new demands on account of any new water requirements like that for navigation, environmental flows, depletion of marine resources, wildlife and sanctuary needs etc."

"31. With reference t o paragraphs 206 to 224 the allegations made therein are baseless and therefore are denied in toto. It is submitted that at the time of sanction and starting of construction of Virdi Project Environment Impact Assessment Notification S.O. 60

(E) dated 27.01.1994 was in force and therefore applicable. As per schedule I of the said notification Environmental Clearance from Central Government was required for river valley projects including hydro power, major irrigation and their combination including flood control. Since Virdi Project was a Minor Irrigation Project no such clearance was required. The central Government approval is not mandatory for Minor Irrigation Projects. It is further submitted that provisions existing under the Forest Conservation Act, 1980 did not require approval as no forest land was affected by Virdi Minor Irrigation Projects. Planning

1260

Commission clearance was also not mandatory for Minor Irrigation Project. It is submitted that appropriate method for assessment of yield at project site has been used. It is denied that the project proposed by Maharashtra would destroy the sustenance and existence of the State of Goa and its people. Maharashtra is not taking any undue advantage of its geographical situation."

728.

It would also be pertinent to notice certain provisions of the relevant enactments.

The Forest (Conservation) Act, 1980 (hereinafter referred to as The Forest Act) *:*

729.

under:

Section 2 of the Forest (Conservation) Act, reads as

"2. Restriction on the der eservation of forests or use of forest land for non-forest purpose.- Notwithstanding anything contained in any other law for the time being

in force in a State, no State Government or other authority shall make, except with the prior approval of the Central Government, any order directing,-

(i)

That any reserved forest (within the meaning of the expression “reserved forest” in any law

for the time being in force in that State) or any portion thereof, shall cease to be reserved;

(ii) That any forest land or any portion thereof may be used for any non-forest purpose;

(iii) That any forest land or any portion thereof may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organisation not owned, managed or controlled by Government;

(iv) That any forest land or any portion thereof may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for reafforestation.

Explanation.- For the purposes of this s ection “non - forest purpose” means the breaking up or clearing of any forest land or portion thereof for-

(a)

The cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticulture crops or medicinal plants;

Any purpose other than reafforestation,

(b)

but does not include any work relating or ancillary to conservation, development and management of forests and wild-life, namely, the establishment of check-posts, fire lines, wireless communications and construction of fencing, bridges and culverts, dams,

1262

waterholes, trench marks, boundary marks, pipelines

or other like purposes.] ”

<u>The Wild Life (Protection) Act, 1972 (in short The Wildlife Act)</u> *:*

730.

The Wildlife Act has been enacted “to provide for the

protection of Wile Animals, birds and plants and for matters

connected thereto or insalaries or incidental thereto with a view

to ensure the colesical an environmental security of the country.”

Section 2(26):

(26) “sanctuary” means an area declared as a

sanctuary by notification under the provisions of

Chapter IV of this Act and shall also include a deemed

sanctuary under sub- section(4) of Section 66.”

Section 29.- “Destruction, etc., in a sanctuary

prohibited without a permit. -

No person shall destroy, exploit or remove any

wild life including forest produce from a sanctuary or

destroy or damage or divert the habitat of any wild

animal by any act whatsoever or divert, stop or

enhance the flow of water into or outside the sanctuary, except under and in accordance with a permit granted by the Chief Wild Life Warden, and no such permit shall be granted unless the State Government being satisfied in change in the flow of water into or outside the sanctuary is necessary for the

improvement and better management of wild life therein, authorities the issue of such permit:

PROVIDED that where the forest produce is removed from a sanctuary the same may be used for meeting the personal bona fide needs of the people living in and around the sanctuary and shall not be used for any commercial purpose."

731.

It has been specifically pleaded by the State of Goa, as is apparent from its pleadings reproduced above, that in the year 1999, part of the Mhadei basin had been declared as Mhadei Wildlife Sanctuary under the provisions of Wild Life Protection Act, 1972. It has also been specifically pleaded by Goa that the entire area of 208 sq. km of the aforesaid Mhadei Wildlife Sanctuary falls within the Mahadayi Basin. It has further been pleaded that the water of river Mahadayi sustains the forest and wildlife in various other Wildlife Sanctuaries in National Parks in the State of Goa, namely, the BhagwanMahaveer National Park and Wildlife Sanctuary in Mollem, Bondla Wildlife Sanctuary in

Bondla Taluk and Dr. Salim Ali Bird Sanctuary in TiswadiTaluka, and river Mhadei is the only river which flows through the entire territory of the Mhadei Wildlife Sanctuary, as well as the Bhagwan National Park and Wildlife Sanctuary, and the Bondla Wildlife Sanctuary. The State of Goa further maintains that any

reduction in Mahadayi water would not only decimate the areas covered by Wildlife Sanctuary and National Park admeasuring 448.5 Sq. Km., but will also result in decimating the surrounding forests, not only in Goa but particularly within the State of Karnataka, since the whole belt is one contiguous belt of forests and wilderness. A specific plea has been taken by Goa that the aforesaid action of the State of Karnataka and State of Maharashtra would not only be in contravention of the Doctrine of Public Trust but also in violation of Wild Life Protection Act, 1972. It has been specifically asserted that the State of Karnataka is trying to divert the water flowing into the Mhadei Wildlife Sanctuary, without any permission from the Chief Wild Life Warden and without any consultation with the National Board of Wild Life. On that basis, Goa has maintained a grievance that the States of Karnataka and Maharashtra have not obtained any approval or permission from any of the authorities under the Wild Life Protection Act, Forest Act and any other relevant enactments. It has also been argued on behalf of the State of Goa that neither the requisite clearances have been obtained from

the Competent Authorities under the various enactments, but even the approval/clearances required from the Central Government, and the Planning Commission (now NITI Aayog),

have not been obtained by these two States and, therefore, neither the State of Karnataka nor the State of Maharashtra, are entitled in law to carry out any diversion project from the Mahadayi river/basin, without the aforesaid clearances/approvals.

732.

The aforesaid pleas taken by the State of Goa have been controverted by the State of Karnataka by filing a reply to the Statement of Claims. The corresponding paragraphs of the reply filed by Karnataka have already been reproduced above. From the reading of the aforesaid paragraphs, viz., para 5.23 (In Re. Para 21), para, 5.24 (In Re: para 21A), para 155D (In Re: para 190C (xxii) & 190C (xxiii), para 5.190D (In Re: para 224-I), it appears, that although the State of Karnataka has chosen to deny the pleadings of the State of Goa, but as may be clear from

the perusal of the corresponding pleas of Karnataka, the facts stated by Goa in the paras extracted above from its Statement of Claims, have not at all been specifically controverted. It has not been denied by the State of Karnataka that Wild Life Sanctuaries, Forests and National Parks are situated within Mahadayi basin and that Mahadayi river flows through Mhadei Wildlife Sanctuary and that the other Wildlife Sanctuaries and Birds Sanctuary are

1266

also in very close proximity of Mahadayi River. The State of Karnataka has merely chosen to generally deny the aforesaid facts, and has maintained that the diversion proposed by Karnataka would have no effect on the wildlife or forests, at all. Although a specific plea has been taken by the State of Goa in Para 2.24(I) of its Statement of Claims (as noticed above) that the State of Karnataka has started the aforesaid project without obtaining any permission from any of the statutory authorities, including the authorities under the Environmental Protection Act, Wild Life Protection Act, Forest Act etc. but in the corresponding para (5.190D), the State of Karnataka has nowhere given any details of any of the approvals/permissions, required under various laws or from the Central Government, having been obtained. It has chosen to remain satisfied by merely stating that there is no law which necessitates that the upstream States shall obtain the consent of the downstream States for construction of any project.

733.

Even the State of Maharashtra has not chosen to give

any details of any approvals/clearances, which it might have obtained.

Consequently, it has to be inferred that even Maharashtra has not obtained any approval from the Central

1267

Government nor has obtained any of the clearances, which are necessary under various enactments.

734.

The Tribunal has given its thoughtful consideration to this aspect of the matter and has also gone through the various provisions of law, brought to its notice.

735.

At the outset, it would be relevant to mention that in the Original Suit proceedings, filed by the State of Goa against State of Karnataka and Ors., before the Supreme Court of India, the aforesaid plea was taken by the State of Goa. A counter affidavit of one Shri K. Vohra, Senior Joint Commissioner (BM), Ministry of Water Resources, Government of India, on behalf of Union of India, was filed. The aforesaid affidavit is available on record of the Tribunal at page 38 of Volume 6. The relevant portion of the aforesaid affidavit is extracted below, for ready reference:

“(iii)APPRAISAL/INVESTMENT

PROJECT:

CLEARANCE

OF

THE

[a] It is submitted that a Committee for

recommending projects to be included in the Second

Five Year Plan was set up by the Planning Commission

in 1954. Later, Planning Commission constituted an Advisory Committee for Irrigation, Flood Control and Multipurpose Projects in 1976. This Committee was entrusted with the functions of getting the project examined by the Central Water Commission (CWC) and Central Electricity Authority (CEA), as required, to determine their techno-economic viability.

[b] The arrangements for scrutiny of techno-economic viability of irrigation, flood control and multipurpose projects were reviewed by the Government and it was decided that the Advisory Committee constituted by the Planning Commission will be replaced by an Advisory Committee in the Ministry of Water Resources (MoWR) which will scrutinise proposals for major/medium irrigation, flood control and multipurpose projects. The said Committee, accordingly, was reconstituted in November, 1987 with Secretary, Ministry of Water Resources as its Chairman and Chief Engineer, CWC as

its Member-Secretary. The Committee has representatives from the Ministry of Finance, Ministry of Energy, Ministry of Environment & Forests, Ministry of Agriculture and Planning Commission.

[c] The function of the Committee is to examine projects proposed by State Governments, Central Government or other organizations and satisfy itself that:

(i) the schemes have been prepared after adequate investigations;

(ii) the estimates are complete and correct technically;

(iii) the financial forecasts and estimates of benefits and anticipated are based on reliable and accurate data; and

(iv) the need of environment conservation and proper rehabilitation of project-affected persons have been taken into account.

[d] On the basis of the examination conducted by the Committee, the Ministry of Water Resources conveys its decision on techno-economic viability of the projects to the Planning Commission. Their inclusion in the Five Year Plans or Annual Plans, as the case may be, could be decided by the Planning Commission having regard to the objectives and strategy of the Plan. At present, all major and or multipurpose and medium irrigation projects and flood control projects including drainage projects which have inter-State ramification are subject to the techno-

economic appraisal in CWC and then approved by the Advisory Committee on Irrigation, Flood Control and Multipurpose Projects in the Ministry of Water Resources. The State Government are empowered to accord investment approval for the major and/or multipurpose and medium irrigation projects and flood control projects including drainage projects which do not have inter-State ramification. Any project which is located on an inter-State river or its tributaries will be deemed to involve inter-State ramifications and as such shall need approval of the Advisory Committee. ”

(Emphasis supplied)

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736.

It is thus clear from the perusal of the stand taken by the Union of India, on this aspect of the matter, that a State Government is empowered to accord investment approval for the major and/or multipurpose and medium irrigation projects and flood control projects, including drainage projects, which do not have any inter-State ramification. However, it is specifically asserted by the Union of India that any project which is located on an inter-State river or its tributaries will be deemed to involve inter-State ramifications and as such shall need approval of the Advisory Committee.

737.

In the case of State of Karnataka Vs. State of Andhra Pradesh &Ors., (2000) 9 Supreme Court Cases 572, the following observations made by the Apex Court may be noticed with advantage:

“Needless to mention that notwithstanding the allocation of water in River Krishna being made en bloc no State can construct any project for use of water

within the State unless such project is approved by the Planning Commission, the Central Water Commission and all other competent authorities who might have different roles to play under different specific statutes .

Under the federal structure, like ours, the Central Government possesses enormous power and authority

and no State can on its own carry on the affairs within its territory, particularly when such projects may have adverse effect on other States, particularly in respect of an inter-State river where each riparian State and its inhabitants through which the river flows has its right."

(Emphasis supplied)

738.

In the case of M.C. Mehta Vs. Kamal Nath&Ors. (1997) 1 Supreme Court Cases 388, the Apex Court held that the notion that the public has a right to expect certain lands and natural areas to retain their natural characteristic is finding its way into the law of the land. The ancient Roman Empire developed a legal theory known as the "Doctrine of the Public Trust". The Public Trust Doctrine primarily rests on the principle that certain resources like air, sea, waters and the forests have such a great importance to the people as a whole that it would be wholly unjustified to make them a subject of private ownership. The said resources being a gift of nature, they should be made freely available to everyone irrespective of the status in life. The

doctrine enjoins upon the Government to protect the resources for the enjoyment of the general public rather than to permit their use for private ownership or commercial purposes. There is no reason why the public trust doctrine should not be expanded to include all ecosystems operating in our natural resources. Our

legal system – based on English common law – includes the public trust doctrine as a part of its jurisprudence. The State is the trustee of all natural resources which are by nature meant for public use and enjoyment. Public at large is the beneficiary of the sea-shore, running waters, air, forests and ecologically fragile lands. The State as a trustee is under a legal duty to protect the natural resources.

739.

Although the State of Karnataka and the State of Maharashtra have denied the pleadings of the State of Goa with regard to the approvals and clearances required for carrying out respective projects, it is clear from the corresponding pleadings of the two States that no approvals, as required by the provisions of Wild Life Protection Act and the Forest (Conservation) Act appear to have been obtained by these two States of Karnataka and Maharashtra, so far.

740.

It is also clear from the perusal of the provisions of Section 2 of the Forest Act that no reserved forest, any forest

land or any portion thereof, can be used by any State Government or other authority except with the prior approval of the Central Government .(Emphasis supplied)

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741.

Section 2(2b) of the Wild Life Protection Act defines "sanctuary" means an area declared as such by a notification under the Act. Section 29 of the said Act specifically lays down that no person shall destroy, explore or remove any wild life including forest produce from a sanctuary or destroy or damage or divert the habitat of any wild animal by any act whatsoever or divert, stop or enhance the flow of water into or outside the sanctuary, except under and in accordance with the provisions of the said Act, which includes a permission to be granted by the Chief Wild Life Warden .(emphasis supplied)

742.

AW-4, Shri Rajendra P. Kerkar, who has appeared as a witness on environment and ecology for the State of Goa, has specifically stated that through various RTI applications filed by him, he had come to know that the State of Karnataka has not taken any statutory permission and necessary clearances under Environment Protection Act, Forest (Conservation) Act and Wild Life Protection Act etc. Even RW-2 Shri A. K. Bajaj, RW2, a witness

appearing for the State of Karnataka, during his cross-examination, has also admitted while answering to Question No. 65 that “the minimum environmental flows required to be

released in the stream has not been quantified. As such, I have not considered the environmental flows in my report. This aspect will be taken care of by the State of Karnataka at the time of obtaining necessary approval."

743.

Shri S. T. Nadkarni, who had appeared as AW-5, an expert witness for the State of Goa, during the course of his cross-examination was referred to his affidavit dated November 14, 2017, and was asked as to how he had mentioned about adverse impact of diversion of water by the States of Karnataka and Maharashtra from Mahadayi Basin on different aspects, as given in the affidavit.

In response, the witness replied that diversion of water by Karnataka and Maharashtra, in their respective territories would be drastic.

He maintained that Karnataka had proposed diversion in and around the wildlife sanctuaries, not only in Goa, but also in Karnataka, and a lot of forest area will not only be inundated along with other areas with

the installation of pumps of more than 5,000 HP. The witness further stated that in Maharashtra also, there would be definitely an adverse impact on the environment.

According to the witness, there would be a cascading damaging effect on the

1275

Wildlife Sanctuaries in Goa, as well as various Wildlife Sanctuaries in the State of Karnataka.

744.

It would be relevant to state here that during the course of proceedings before this Tribunal, the State of Karnataka had filed an Interlocutory Application No. 60 of 2015, with Interlocutory Application No. 66 of 2016. An interim prayer was made by the applicant State of Karnataka to be permitted, at its own cost for lifting or pumping of 7 tmc of water annually from Mahadayi basin. The aforesaid applications were rejected by this Tribunal vide a detailed order dated 27.7.2016. The State of Goa, besides taking various other objections, had opposed the said prayer made by Karnataka, by maintaining that necessary clearances/permissions had not been obtained by the State of Karnataka and, therefore, the said interim prayer could not be granted. The following paragraphs of Order dated 27.7.2016 passed by the Tribunal may be relevant to extract here:

“107. Before making such huge construction as mentioned above, no permission as on date, has been obtained by the State of Karnataka, either under the Water (Prevention and Control or Pollution) Act, 1974

or the Environment (Protection) Act, 1986 or Wild Life Protection Act or Bio Diversity Act or from the Central Government or from the Planning Commission."

"112. Therefore, the statement made by the State of Karnataka, in the present case, to the effect that after permission to transfer 7 tmc of water is granted by the Tribunal, necessary clearances/permissions would be obtained under various provisions of different Acts cannot be accepted by the Tribunal. Such a course cannot be permitted to be adopted by the State of Karnataka."

"113. It is necessary for the State of Karnataka to obtain relevant clearances under different Acts before seeking lifting or pumping of 7 tmc of water from Mahadayi basin to Malaprabha basin."

745.

Even during the course of final hearing, while addressing the arguments, the State of Karnataka has not shown, at all, that the requisite clearances and approvals have been

obtained by it from the various Statutory Authorities, Central Government and the Planning Commission (now NITI Aayog).

746.

From the material available on the record, and the corresponding pleadings of the parties, and also specific averments contained in the counter Affidavit filed by the Union

of India in the proceedings of the Original Suit in the Supreme Court of India, it is clear that although the approvals and clearances from the Central Government and the Planning Commission (now NITI Aayog), under the various laws are required for the projects being undertaken by the State of Karnataka and State of Maharashtra, such permissions have not been obtained, so far, by any of them.

747.

In view of the aforesaid discussion, the Tribunal has no hesitation in holding that the State of Goa has proved on record, as a matter of fact, and also shown in law, that the requisite approvals and clearances required by the State of Karnataka and State of Maharashtra have not been obtained from various Statutory Authorities, Central Government and Planning Commission (Now NITIAayog).

748.

Consequently, Issue No. 2 and Issue No. 31 are decided in favour of the State of Goa and against the States of Karnataka and Maharashtra.

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749.

At this stage, it would be appropriate to take up another ancillary and connected topic, which arises from the rival pleadings of the parties.

750.

In its amended Statement of Case filed by the State of Goa (Volume 131), in para 64, making a grievance against the project proposed by the State of Karnataka and the incidences connected therewith, the State of Goa has maintained that if the aforesaid attempts of State of Karnataka are permitted to be proceeded with, the same will seriously affect the very sustenance of Mahadayi River/Mahadayi River Basin, and, in turn, will affect the very sustenance of the State of Goa and its people. After giving the various details of the damage which the State of Goa apprehended that it would suffer, it maintained that the aforesaid proposals by the State of Karnataka were being undertaken without even considering the disastrous effect on the State of Goa or without obtaining any consent from the State of Goa .(Underliningdone)

751.

In para 80 of the aforesaid Statement of Case, a reference has been made by the State of Goa to a communication dated April 11, 2001 by the Secretary, Irrigation,

1279

Government of Maharashtra to Secretary, Irrigation, Government of Karnataka, requesting the Government of Karnataka not to unilaterally proceed with any outside basin diversion of water of the Mandovi and Tillari River Basins, without prior consent by Maharashtra, or a concluded inter-State agreement.

752.

Similarly, in various paragraphs of the Statement of Case, the State of Goa, and even the State of Maharashtra, have pleaded that the State of Karnataka had not obtained any prior consent, before planning or undertaking the project of diversion of water from Mahadayi River/Mahadayi Basin to outside the basin.

753.

The State of Karnataka while filing its reply to the aforesaid stand of Goa and Maharashtra has maintained that no such prior consent or approval by an upper riparian State was required from the lower riparian State.

754.

The State of Karnataka has pleaded as follows:

“Para 5.190 D of the reply on behalf of State of Karnataka (Volume 138) has already been reproduced in the above portion and need not be repeated again.

1280

It would be sufficient to notice that the State of Karnataka has specifically maintained that “there is no law which insists that the upstream States shall obtain the consent of the downstream States for construction of any project. It aims to bestowing veto power on the downstream State of Goa.”

755.

With regard to the aforesaid controversy between the parties, the Tribunal had framed the following issues:

ISSUE No. 25:

“Whether the State of Goa proves that the State of Karnataka and the State of Maharashtra do not have any right, authority or power to divert the waters of river Mahadayi outside the river basin without the concurrence of the State of Goa?”

ISSUE NO. 26:

“Whether it is proved by the State of Goa that no co - basin State can take up any project on an inter-State river without the consent of the riparian State?”

ISSUE NO. 48:

“Whether the State of Karnataka establishes that it has a right to construct a project unilaterally without consent or concurrence of the co-riparian State as held in the case of State of Karnataka versus State of Andhra Pradesh in (2000) 9 SCC 572 at 640?”

1281

ISSUE NO.59:

“Whether the State of Maharashtra proves that the State of Karnataka should not be allowed to divert waters outside the basin without the consent of the State of Maharashtra and the State of Goa? ”

756.

The Tribunal having given its due consideration to the aforesaid controversy between the parties, it would be appropriate to first notice the legal position with regard to the same.

757.

In the case of State of New Jersey versus State of New York etc. (283 U.S.336-348.), the Supreme Court of United States made the following observations:

“A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it. New York has the physical power to cut off all the water within its jurisdiction. But clearly the exercise of such a power to

the destruction of the interest of lower States could not be tolerated. And on the other hand equally little could New Jersey be permitted to require New York to give up its power altogether in order that the river might come down to it undiminished. Both States have real and substantial interests in the River that must be reconciled as best they may be. The different

traditions and practices in different parts of the country may lead to varying results but the effort always is to secure an equitable apportionment without quibbling over formulas."

758.

Further, in case of **State of Kansas versus State of Colorado (206) US 46** ,certain observations made by the Supreme Court of United States, which have also been quoted by the Supreme Court of India in a subsequent case, (to be referred later) are extracted below:

"One cardinal rule, underlying all the relations of the States to each other, is that of equality of right. Each State stands on the same level with all the rest. It can impose its own legislation on no one of the others, and is bound to yield its own views to none…the action of one State reaches, through the agency of natural laws, into the territory of another State, the question of the extent and the limitations of the rights of the two States becomes a matter of justiciable dispute

between them and this Court is called upon to settle that dispute in such a way as will recognise the equal rights of both and at the same time establish justice between them."

"The dispute is of a j usticiable nature to be adjudicated by the Tribunal and is not a matter for legislative jurisdiction of one State…."

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“The right to flowing water is now well settled to be a right incident to property in the land; it is a right publici juris, of such character that, whilst it is common and equal to all through whose land it runs, and no one can obstruct or divert it, yet, as one of the beneficial gifts of Province, each proprietor has a right to a just and reasonable use of it, as it passes through his land, and so long as it is not wholly obstructed or diverted, or no larger appropriation of the water running through it is made than a just and reasonable use, it cannot be said to be wrongful or injurious to a proprietor lower down….”

“The right to the use of flowing water is publici juris, and common to all the riparian proprietors; it is not an absolute and exclusive right to all the water flowing past their land, so that any obstruction would give a cause of action; but it is a right to the flow and enjoyment of water, subject to a similar right in all the proprietors, to the reasonable enjoyment of the same

gift of Providence. It is, therefore, only for an abstraction and deprivation of this common benefit, or for an unreasonable and unauthorised use of it that an action will lie."

759.

The Supreme Court of India **In the matter of Cauvery Water Disputes Tribunal reported in 1993 Supp, (1) SCC 96 (II)** , while noticing the law laid down by the US Supreme Court in the above quoted case of the State of Kansas versus State of Colorado, made the following observations:

“Though the waters of an inter -State river pass through the territories of the riparian States such waters cannot be said to be located in any one State. They are in a state of flow and no State can claim exclusive ownership of such waters so as to deprive the other States of their equitable share. Hence in respect of such waters, no State can effectively legislate for the use of such waters since its legislative power does not extend beyond its territories. It is further an acknowledged principle of distribution and allocation of waters between the riparian Sates that the same has to be done on the basis of the equitable share of each State. It is against the background of these principles and the provisions of law we have already discussed that we have to examine the respective contentions of the parties.

The Ordinance is unconstitutional because it affects the jurisdiction of the Tribunal appointed under the Central Act, viz., the Inter-State Water Disputes Act

which legislation has been made under Article 262 of the Constitution. As has been pointed out above, while analysing the provisions of the Ordinance, its obvious purpose is to nullify the effect of the interim order passed by the Tribunal on June 25, 1991. The Ordinance makes no secret of the said fact and the written statement filed and the submissions made on behalf of the State of Karnataka show that since according to the State of Karnataka the Tribunal has no power to pass any interim order or grant any interim relief as it has done by the order of June 25, 1991, the order is without jurisdiction and, therefore, void ab

initio. This being so, it is not a decision, according to Karnataka, within the meaning of Section 6 and not binding on it and in order to protect itself against the possible effects of the said order, the Ordinance has been issued. The State of Karnataka has thus arrogated to itself the power to decide unilaterally whether the Tribunal has jurisdiction to pass the interim order or not and whether the order is binding on it or not. Secondly, the State has also presumed that till a final order is passed by the Tribunal, the State has the power to appropriate the waters of the river Cauvery to itself unmindful of and unconcerned with the consequences of such action on the lower riparian States. Karnataka has thus presumed that it has superior rights over the said waters and it can deal with them in any manner. In the process, the State of Karnataka has also presumed that the lower riparian States have no equitable rights and it is the sol judge as to the share of the other riparian States in the said

waters. What is further, the State of Karnataka has assumed the role of a judge in its own cause. Thus, apart from the fact that the Ordinance directly nullifies the decision of the Tribunal dated June 25, 1991, it also challenges the decision dated April 26, 1991 of this Court which has ruled that the Tribunal had power to consider the question of granting interim relief since it was specifically referred to it."

760.

Once again, it would be absolutely necessary to notice the law laid down by the Supreme Court of India in the case of

1286

State of Karnataka versus State of Andhra Pradesh and others, (2000) 9 Supreme Court Cases 572 .

761.

The issue No. 9 of the aforesaid matter, which is identical in part to the present matter in controversy is relevant to be extracted below:-

“9. (a) Whether the construction of the Almatti Dam with FRL of 524.256 m together with all other projects executed, in progress and contemplated by Karnataka would enable it to utilise more water than allocated by the Tribunal? (A.P.)

(b) Whether Karnataka could be permitted to proceed with construction of such a dam without the consent of other riparian States, and without the approval of the Central Government? (A.P.)”

762.

The aforesaid question was answered by the Supreme Court (page 641) as follows:

“Needless to mention that notwithstanding the

allocation of water in River Krishna being made en bloc no State can construct any project for use of water within the State unless such project is approved by the Planning Commission, the Central Water Commission and all other competent authorities who might have different roles to play under different specific statutes.

Under the federal structure, like ours, the Central Government possesses enormous power and authority and no State Can on its own carry on the affairs within its territory, particularly when such projects may have adverse effect on other States, particularly in respect of an inter-State river where each riparian State and its inhabitants through which the river flows has its right."

Further it was observed as follows:

" Though it may be fully desirable for all the States to know about the developments of the other States but neither the law on the subject requires that a State even for utilisation of its own water resources would take the consent of other riparian States in case of an inter-State river .So far as the second part of sub-issue (b) is concerned, the answer is irresistible that the project of each State has to be approved by the Central Government as well as by other statutory authorities and the Planning Commission, but for which a State should not proceed with the construction of such

project. Issues 9(a) and (b) are answered accordingly."

(Underlining supplied).

763.

In a recent pronouncement by the Apex Court in the case of **Stateof Karnataka versus State of Tamil Nadu (2018) 4SCC1** ,the following observations, by the Apex Court, may be noticed:

“394. As enunciated by this Court in Cauvery Water Disputes Tribunal, in re, the waters of an inter-State river passing through the corridors of the riparian States constitute national asset and cannot be said to be located in any one State. Being in a state of flow, no State can claim exclusive ownership of such waters or assert a prescriptive right so as to deprive the other States of their equitable share. It has been propound therein that the right to flowing water is well settled to be a right incident to property in the land and is a right publici juris of such character, that while it is common and equal to all through whose land it runs and no one can obstruct or divert it, yet as one of the beneficial gifts of nature, each beneficiary has a right to just and reasonable use of it. We endorse the view of the Tribunal in the attendant perspectives that the acknowledged principle of distribution and allocation of waters between the riparian States has to be done on the basis of their equitable share, however

contingent on the facts of each case."

764.

From the settled legal position, as noticed above, it is clear that the waters of an inter-State river passing through one or more riparian States constitute a national asset and cannot be said to be located in any one of such States, and being in a State of flow, no State can claim exclusive ownership of such waters or assert a prospective right, so as to deprive the other States of their equitable share. The Apex Court has laid down that right to water of an inter-State river shall be adjudicated between the

riparian States on the basis of their equitable share and distribution, depending upon the facts of each case.

765.

In the face of the law laid down by the Apex Court, more specifically in the case of State of Karnataka versus State of Andhra Pradesh (Supra), the settled position of law is that no State can construct any project for use of water within the State, unless such project is approved by the Planning Commission, the Central Water Commission and all other competent authorities, who might have different roles to play under different specific Statutes. Under the Federal structure of the country, the Central Government possesses enormous powers and authority and no State can on its own carry on the affairs within its territories, particularly when such projects may have adverse effect on other States, more particularly in respect of an inter-State river where each riparian State through which the river flows, and its inhabitants, has its right, but no law on the subject requires that a State even for utilisation of its own water resources would require the consent of other riparian States in case of an inter-

State river.

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766.

In

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pronouncements by the Apex Court, and the settled law on the matter, this Tribunal has no hesitation in holding that the upper riparian States of Karnataka and Maharashtra, though do require requisite clearances and approvals, as required by law and from the Central Government, and the Planning Commission (Now NitiAyog), but they do not require any prior consent of the lower riparian State of Goa and similarly the State of Maharashtra, being an upper riparian State vis.-a-vis. the State of Goa, also does not require any such prior consent of the State of Goa. Issues No. 25, 26, 48 and 59 are decided accordingly.

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - VII

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – VII

Sl. No.

1.

D E S C R I P T I O N

Decision and findings by the Tribunal on

important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the**

period from June, 1901 to May,

2013

1291 - 1443

1444 - 1500

PAGE NOS

1291

HYDROLOGY AND WATER AVAILABILITY

767.

The Mahadayi river is a west flowing river, which is also known as Mandovi river or Madei river in the State of Goa. It drains a total drainage area of 2032 sq.km. in the Western Ghats before falling into the Arabian Sea. Out of a total catchment area of 2032 sq.km., 375 sq.km. of catchment area lies in the State of Karnataka and 77 sq.km. in the State of Maharashtra. Rest of the Catchment area i.e., 1580 sq.km. lies within the State of Goa.

768.

Three party States, namely the States of Goa, Karnataka and Maharashtra have indicated different values of water availability at different points in the Mahadayi river basin and at different dependability, through their respective Statements of Case / Statement of Claims or Affidavits of the Expert Witnesses or through the evidence of the Expert Witnesses during the course of Cross Examinations which are as under.

a. Water availability at 75% dependability and

dependability, is assessed, by the State of Goa for:

50%

1292

i.

Entire Mahadayi basin i.e., for the catchment area of 2032 sq.km.

Usable yield from catchment area of 1523 sq.km. (i.e., after deducting 509 sq.km. from total catchment area of 2032 sq.km. to assess the ‘usable yield’, which according to State of Goa is generated from an area of 1523 sq.km. only)

Kotni Dam (independent catchment) with catchment area of 93.19 sq.km., Bhandura dam with catchment area of 32.25 sq.km., Bailnadi with catchment area of 32.33 sq.km., Kalasa (including Haltara and Surla diversions) with catchment area of 25.50 sq.km., Irti Diversion with catchment area of 8.78 sq.km., Irti pickup dam with catchment area of 9.91 sq.km., Katla-Palna Diversion with catchment area of 22.50 sq.km., Diggi Diversion with catchment area of 15.60 sq.km., and Viranjole Diversion with catchment area of 9.50 sq.km.

ii.

iii.

b. Water availability at 75% dependability and 50% dependability, is assessed, by the State of Karnataka for:

i.

Entire Mahadayi basin i.e., for the catchment area of 2032 sq.km.

Catchment area of Mahadayi basin in Karnataka territory (i.e., for catchment area of 375 sq.km.)

Kalasa dam (including Haltara and Surla diversion) with catchment area of 25.50 sq.km., Bhandura dam with catchment area of 32.25 sq.km., Kotni Dam site

ii.

iii.

1293

(including Bhandura dam catchment and diversion of Irti, Bailnadi) with catchment area of 125.44 sq.km., Kotni Dam site (independent catchment) with catchment area of 93.19 sq.km., Bailnadi dam (diversion) with catchment area of 32.33 sq.km., Irti dam (diversion) with catchment area of 8.78 sq.km., Irti Pickup Dam (Independent Catchment) with catchment area of 9.91 sq.km., Katla-Palna diversion with catchment area of 22.50 sq.km., Diggi diversion with catchment area of 15.60 sq.km., and Viranjole diversion with catchment area of 9.50 sq.km.

c. Water availability at 75% dependability, 50% dependability and also the average water availability is assessed by the State of Maharashtra for:

i.

Entire Mahadayi basin i.e., for the catchment area of 2032 sq.km.

Catchment area of Mahadayi basin in Maharashtra territory i.e., catchment area of 77 sq.km.

The Tribunal notices that the State of Karnataka and

ii.

769.

the State of Maharashtra have estimated the water availability for the entire Mahadayi basin with catchment area of 2032 sq.km. However, the State of Goa has estimated (a) the water availability for the entire Mahadayi basin with total catchment area of 2032 sq.km., and also (b) the water availability from catchment area of 1523 sq.km. The water availability from the

total catchment area has been termed as “runoff over the entire catchment” i.e., yield from the catchment area of 2032 sq.km. The State of Goa has estimated the water availability from catchment area of 1523 sq.km. i.e., after excluding an area of 509 sq.km. from the total catchment area of 2032 sq.km. It has been termed as ‘Usable Yield’ in his report by Shri Chetan Pandit, Expert Witness for the State of Goa.

Exclusion of 509 sq.km. from total catchment area of 2032 sq.km. by the State of Goa for assessment of yield of the Mahadayi basin

770.

From the Issue No. 10 relating to water availability, it is apparent that the State of Goa has used three different terms namely (a) annual runoff, (b) annual yield, and (c) annual safe yield. The State of Goa has used: (a) the term ‘annual runoff’ in respect of water availability from the entire catchment area of 2032 sq.km. of the Mahadayi basin; (b) the term ‘annual yield’ in respect of water availability from catchment area of 1523 sq.km. i.e., after excluding an area of 509 sq.km. from the total

catchment area of 2032 sq.km. of the Mahadayi basin; and (c) the term ‘annual safe yield’ in respect of water availability from

1295

catchment area of 982 sq.km. i.e., after excluding an area of 1050 sq.km. from the total catchment area of 2032 sq.km. of the Mahadayi basin.

771.

Tribunal notices that Issue No. 24 framed for determination is specifically related to exclusion of an area of 1050 sq.km. from the total catchment area of 2032 sq.km. of the Mahadayi basin. Issue No. 24 reads as under.

“ **IssueNo. 24** :Does the State of Goa establish that for the purpose of estimation of water yield at different dependability, an area of 1050 sq. km. (out of total catchment area of 2032 sq. km.) is required to be excluded?”

772.

The Tribunal finds that at Para 179D, pages 214 to 216 of the Statement of Case filed by the State of Goa (Volume 131), State of Goa has also raised the issue of non-inclusion of an area of 1050 sq.km. from the total catchment area of 2032 sq.km. of Mahadayi basin in the CWC Report of 2003, for the purpose of

determination of 75% and 50% dependable yield. It is, however, noticed by the Tribunal that subsequently at Para 179N, page 222 (Volume 131), the State of Goa has mentioned that a Report of IIT, Bombay has assessed the catchment area to be excluded as

501 sq.km., and not 1050 sq.km as mentioned at Para 179D. The Tribunal also finds that on the other hand, Shri Chetan Pandit, in his Report of August 2016 (Volume 191), has considered 509 sq.km. as the area to be excluded to assess the water availability in the Mahadayi river basin.

773.

Shri Chetan Pandit, Expert Witness of the State of Goa has discussed the related matter under Para 15, page 55 of his Report of August 2016 (Volume 191) and has concluded as under.

“Thus, in this case of Ma ndovi River basin while the total yield may be estimated for a catchment area of 2032 SqKm, usable yield has to be estimated only on the area 1523 Km 2 being = 2032-509 Km 2 .”

774.

The above statement of Shri Chetan Pandit, presents an entirely different scenario from what is reflected in the specific issue framed for determination i.e., Issue No. 24 which is based on averments made in Para 179E, page 217, Para 179L, page 221 and Para 179M, pages 221-222 of the Statement of

Case of the State of Goa (Volume 131).

775.

The issue of exclusion of a part of the catchment area

for assessment of yield of the basin has not been addressed in

the Affidavits or the Reports of the Expert Witnesses of the States of Karnataka and Maharashtra.

776.

On the suggestion of Shri Chetan Pandit, Expert Witness for the State of Goa, to exclude an area of 509 sq.km. from the total catchment area of 2032 sq.km. of Mahadayi basin, several questions were put to him during the cross examination by the learned Counsel of the State of Karnataka. In reply to questions No. 98 put to Shri Pandit on 3.10.2016, Shri Chetan Pandit stated as under.

“The words I have used are “Thus, in this case of Mahadayi River Basin while the total yield may be estimated for a catchment area of 2032 Sq. Km., usable yield has to be estimated only on the area 1523 Sq. Kms. being = 2032 – 509 Km 2 ”. The word “Usable” is important. ”

(Emphasis supplied)

777.

At Para 15, pages 54- 55 of his Report titled “Yield

Study for Mahadayi River Basin" filed on 4.8.2016 (Volume 191), Shri Chetan Pandit has mentioned that, exclusion of a part of the catchment from the yield studies, is a standard practice and in this regard, he has cited the following cases.

1298

- TheHon’ble Krishna Water Disputes Tribunal has allotted the yield of the Krishna basin only up to Prakasam barrage.
- TheHon’ble Narmada Water Disputes Tribunal has allotted the yield of the Narmada basin only up to the Sardar Sarovar dam site.
- TheHon’ble Cauvery Water Disputes Tribunal has allotted the yield of the Cauveri basin only up to an anicut known as the Lower Anicut.
- TheHon’ble Godavari Water Disputes Tribunal has allotted the yield of the Godavari basin only up to the Dowleshwaram anicut.

778.

During the course of cross examination by Shri Mohan V. Kataraki, learned Counsel for the State of Karnataka, Shri Pandit admitted that excluded area in case of Krishna basin was only about 0.72% (reply to question No. 106) and that the excluded area in case of Mahadayi basin was about 25.05% (reply to question No. 107). In reply to question No. 108 put by Shri Mohan V. Kataraki, learned Counsel for the State of Karnataka,

Shri Pandit, has further stated that he had not come across a case where about 25% of the basin area was excluded from

computation of the basin yield in India. Question No. 108 and his reply thereof are reproduced hereunder.

“Q. No. 108. During your career in the Central Water Commission and as a consultant after your retirement, have you come across any other basin in India or outside India, where such a large area of 25% of the catchment was excluded from the estimation of the yield of the basin?

Ans. I have not studied any basin outside India. But within India I have not come across a case where about 25% of the area was excluded from computation of the yield. Having said that I must clarify that the percentage of area excluded is determined by the topography. Mahadayi is, to the best of my knowledge, the first instance of a Western Ghat basin which is being thus adjudicated. The Western slope of the Western Ghats is a very narrow strip. If a similar study was to be made for other Western Ghat rivers, the results would be comparable.”

779.

Further, in reply to Question No. 173 put by the Tribunal on 6.10.2016 on this issue, Shri Chetan Pandit, inter-alia, stated as under.

“In the Paragraph 179L and 179M of State of Goa’s Amended Statement of Case, filed on 23.04.2015, there is reference to “The said Report”. Perhaps this is a yield Report prepared by Prof. V. Jothiprakash. In that report

1300

the terms run-off and yield were used in a particular manner. He used the run-off to indicate the water accruing from rainfall over the entire catchment and the term 'yield' to indicate the usable part of the run - off by excluding some part of the catchment, from where the run-off cannot be utilized for various reasons. In CWC we did not use these terms in the way he has used them ...."

(Emphasis supplied)

780.

Apart from the fact that the area not considered for the purpose of assessment of water availability of Krishna basin for apportionment among the party States, is only about 0.72%, the Tribunal notes that the decision to assess the water availability up to Vijayawada weir by Krishna Water Disputes Tribunal I and up to Prakasham barrage by Krishna Water Disputes Tribunal II, was in view of general agreement. At Para 234 of Chapter IX on page 73 of the volume I of the Report of the Krishna Water Disputes Tribunal – I, it is stated that "i t is

generally agreed that the volume of water which passes over and through the Vijayawada Weir would give us a fair idea of the volume of flow in the river after the upstream utilisations are added to it". The Krishna Water Disputes Tribunal – II has also adopted the same and at page 275 of its Report, it is stated that "after considering the flow data at the terminal point viz.

1301

Prakasham barrage, next important component to arrive at is upstream utilization".

781.

From the information available at the web site of the Sardar Sarovar Narmada Nigam Limited, it is found that the total basin area of the river is 97,410 sq.km. and the catchment area upto the dam site is 88,000 sq.km. Thus, the area downstream of the Sardar Sarovar dam is 9,410 sq.km. i.e., about 9.7% of the total area of the basin. However, the exclusion of the area for the purpose of assessment of water availability of the Narmada basin was not an issue at all. The Issue No. 7 framed for determination by Narmada Water Disputes Tribunal as indicated at page 3 of the Volume I of the Report of the Tribunal is reproduced hereunder.

"7. What is the utilisable quantum of waters of Narmada at Navagam dam site on the basis of 75 per cent or other dependability and how should this quantum be apportioned among the States of Gujarat, Maharashtra, Madhya Pradesh and Rajasthan?"

Therefore, the question of exclusion of an area for the purpose of assessment of water availability of the Narmada basin does not arise.

1302

782.

Shri Chetan Pandit has stated that the Hon'ble Cauvery Water Disputes Tribunal has allocated the yield of the Cauvery basin only up to an anicut known as the Lower Anicut. The area downstream of the Lower Anicut across Coleroon, is about 9.8% of the total catchment area of 81,155 sq.km. of the Cauvery basin. In this regard, the Tribunal notes that the assessment of yield of the Cauvery basin was made by the Cauvery Fact Finding Committee constituted by the Government of India on 12 th June 1972, and the same was accepted by the Cauvery Water Disputes Tribunal. The Cauvery Fact Finding Committee has assessed the yield up to Grand Anicut. The relevant extract from page no. 72 of the Report of the Cauvery Fact Finding Committee are reproduced hereunder.

" **GrandAnicut**

The figures of utilisation at the Grand Anicut for the 38 years from 1934-35 to 1971-72 have been supplied by the Government of Tamil Nadu. To these, the annual realisations, the surplus at Upper Anict for the

corresponding year have been added to arrive at the realisations at Upper Anicut. For arriving at the utilisation at Lower Anicut, the difference in flow at the Lower Anicut and the releases of surplus from the Upper Anicut and the Grand Anicut is obtained and added to

the realisations at Upper Anicut. Thus the realization worked out would represent the yield from the Cauvery basin up to Grand Anicut and the yield of the Coleroon river but would exclude the runoff from the Cauvery / Vennar systems which are drained by these systems into the sea. …"

783.

Shri Chetan Pandit has stated that the Hon'ble Godavari Water Disputes Tribunal has allotted the yield of the Godavari basin only upto the Dowleshwaram anicut, excluding an area of 3545 sq.km. The area of 3545 sq.km. is only1.1% of the total catchment area of 312812 sq.km. of the Godavari river. However, the point which is important is that, in case of Godavari, the issue of water availability was addressed in view of the several agreements among the party States. The Sub-issue No. 1 under Issue No. III reads as under.

"(1) On what basis should the available waters be determined?"

The decision of the Godavari Water Disputes Tribunal on the Issue No. III at Para 135, page 46 of its Report, is reproduced hereunder.

“The Agreements filed by the parties have apportioned the waters of the Godavari river between them.

In the Agreement dated the 7 th August, 1978 between the States of Maharashtra, Madhya Pradesh and Andhra Pradesh, the three States have agreed to set up a duly constituted Tripartite Inter-State Control Board for Inchampalli Project *inter-alia* forits operation and maintenance. Except as aforesaid the Agreements filed by the parties do not provide for setting up of any machinery by the Tribunal for making available and regulating the allocations of water to the States concerned or otherwise to implement the Agreement between the parties or the decision of the Tribunal.

Issue No. III (8) is disposed of accordingly.

No other question arises under Issue No. III in view of the Agreements between the parties and the Issue is

disposed of accordingly.”

784.

From above, it is evident that the yields at terminal points have been assessed on consideration of various issues and facts and the same have been used for the purpose of apportionment of water among the party States. However, in all cases, it is clearly stated that the yield is at the terminal point,

and that in no case, the yield at such terminal point, is defined as yield from the basin. It is also noted by the Tribunal that in none of the cases, aspects related to intrusion of the saline water from the sea / ocean and its mixing with the fresh water and rendering it unfit for any human, has been cited as a reason for excluding any part of the basin for the purpose of assessment of yield. Thus, the statement of Shri Pandit that “when yield is estimated for the purpose of estimating the quantity of water available for use, it is standard practice to exclude this part of the catchment from the yield studies” is not based on fact and is factually incorrect.

785.

The Tribunal finds that the yield of Drainage Basin has been defined in the IS:4410 (Part XI/Sec 2) – 1972 at para 2.66 as “Total volume or flow from a drainage basin for a long stipulated period of time, for example ‘annual yield of a drainage basin’ is mean annual runoff”. Further, the term “yield of a river” has been clearly defined in the report of the Cauvery Water Disputes Tribunal. The very first sentence of Chapter – I of Volume III –

Availability of Water, of the Report of the Cauvery Water Disputes Tribunal states that “ The yield of a river system is the annual vir gin flows at its terminal site”. In the question No. 173,

1306

Shri Chetan Pandit was also specifically asked whether he agreed with the above mentioned definition of yield as given in the Indian Standard Code or that included in the Report of the Cauvery Water Disputes Tribunal. In his reply, Shri Chetan Pandit did not specifically convey his disagreement with the definition of yield as given in the Indian Standard Code or that included in the Report of the Cauvery Water Disputes Tribunal but linked it to the outfall point on the river. The relevant extract from his reply is reproduced hereunder.

"… In IS Codes they do not make a distinction between a tributary which meets a larger river at a specific point vis-à-vis a large river which outfalls into an ocean or sea. The river which outfalls into the sea/ocean would pass through a delta and estuarine phase, whereas a tributary has no delta, no estuary. Obviously, the definition of catchment for the purpose of allocation of utilizable yield of a river which is a tributary, for example the Yamuna, will have to be different from the definition for a river which may be small, but is an

independent river out falling into a sea or an ocean. …”

786.

Shri Subrai T. Nadkarni, AW5, who is examined on behalf of the State of Goa, has stated in reply to Q.No.19 by the learned Counsel of the State of Karnataka, that the small quantum of water available is mainly used for protective

irrigation. The Question No. 19 and the reply thereof are reproduced hereunder.

“Q.No.19. Please refer to question No. 11, and your answer thereto. I show you the statement of list of projects completed and also proposed by the State of Goa in the area of 509 Sq. Km.

(PER TRIBUNAL: The learned counsel for the State of Karnataka has handed over to the witness a statement containing “List of projects completed by Goa in the excluded Zone of 509 Sq. Km. utilising 3.305 TMC in Mahadayi basin”. The statement is taken on r ecord and is marked as MARK-KA/24.)

If the water generated in the zone of 509 Sq. Km. is not utilisable, and cannot be treated to be a part of yield, then how did Goa plan these projects?

Ans. I have gone through the list contained in the document MARK-KA/24, handed over to me, and I wish to state that many of the projects listed therein, either do not lie in the 509 Sq. Km. area, as shown in the list or

some minor schemes like very small bandharas, ponds are included in the said 509 Sq. Km. zone, and I wish to state that the small quantum of water available is mainly used for protective irrigation.

I may add that the projects listed at Sl. No.1, 2, 3, 5 and 7, all the lift irrigation schemes and all the water supply schemes, do not lie within the 509 Sq. Km. zone."

1308

It becomes necessary for the Tribunal to examine the question as to what is ‘protective irrigation’. The dominant design practice in irrigation engineering is, to design irrigation systems, in such a manner that water supply covers the full crop water requirements, either completely by irrigation or in addition to rainfall. The ‘protective irrigation’ systems are designed and operated on the principle that available water in rivers or reservoirs, has to be spread thinly over a large area, in an equitable manner. The idea is to reach as many farmers as possible, and to protect them against crop failure and famine, which would regularly occur without irrigation in regions with low and erratic rainfall. The general aim of protective irrigation translates into specific technical, organizational and socio-economic characteristics. In technical sense, protective irrigation implies spreading water thinly into ‘light crops’ i.e. low water demanding, which are envisaged to be grown and water is rationed on the basis of available supplies. Thus, in water terms, it is characterized by high duties i.e. low unit water supplies and low design intensities. In protective irrigation schemes, crop

water requirements of the full command area are not met, nor taken into account in the design of the scheme. Protective systems are completely supply oriented. The systems are

designed for continuous flow and automatic water distribution, implying low levels of management intensity. In an organizational sense, protective irrigation implies distributing limited amounts of water over a large number of people. To achieve this, a system of organizational arrangements has to be devised that makes farmers accept less water than is needed for the full growth of their crops, so that other farmers can also have water. In a socio-economic sense, protective irrigation means the maximization of returns per unit of water instead of unit of land and thereby maximizing total social benefits. From a national economic perspective, protective irrigation makes sense because it maximizes agricultural output given the limited availability of water, generates more employment and spreads the benefits over a large number of producers. Thus, for the purpose of assessment of water availability for meeting the consumptive demand, the ‘protective irrigation’ is, same as irrigation. Schemes developed in 509 sq.km., for utilizing the water generated over the area, which also forms part of the catchment of Mahadayi Basin, plays its own role in maximizing agricultural output of light

crops and benefits thereof reach to large number of farmers. Therefore, once the water generated over a piece of land, say, in this case, 509 sq. km. of land, is utilized for any beneficial use,

including protective irrigation, such land cannot be excluded from the total catchment area of Mahadayi basin, while estimating yield of Mahadayi basin.

787.

From above, it is clear that the yield of a river basin cannot be defined with reference to usability of water from the consideration of its productive use for human beings, animals or agriculture. Thus, the contention of the State of Goa that, for the purpose of estimation of water yield at different dependability, an area of 509 sq.km. or 1050 sq.km. (out of total catchment area of 2032 sq. km.) is required to be excluded, is not justified. The Tribunal is of the considered view that the water availability or yield of the Mahadayi basin must be assessed on the basis of total catchment area of the river basin, viz., 2032 sq.km. Thus, issue No. 24 is answered in negative, by the Tribunal.

788.

The Tribunal finds that the methodology for assessment of water availability used by all the three party States, namely Goa, Karnataka and Maharashtra and that

adopted by the Expert Witnesses appearing on behalf of them are broadly same, i.e. all have used linear regression equation to assess the water availability from average rainfall over the basin

computed with the help of rainfall data of few selected rain gauge stations. However, in view of the various deficiencies noticed in the data/data processing by them, it has become important for the Tribunal to have a critical review of the values of water availability reported by the three States, either through the Statement of Case of State of Goa and State of Maharashtra / Statement of Claims of State of Karnataka or Affidavits of the Expert Witnesses or through the answers / explanations given by their respective expert witnesses, during the course of Cross Examinations.

789.

In the first instance, the water availability for the entire Mahadayi basin has been examined as under:

Water Availability Estimated by the State of Goa

790.

Based upon suggestions of the State of Goa, the Issue No. 10 relating to the water availability in Mahadayi basin was framed for determination, which is reproduced hereunder.

“10. Whether the State of Goa establishes that (a) the

75% and 50% dependable annual runoff in the entire

Mandovi River Basin is 4110.79 M.cu.m (145.05 TMC)

and 4632.178 M.cu.m (163.45 TMC) respectively, (b) the 75% and 50% dependable annual yield is 3081.07 M.cu.m (108.72 TMC) and 3471.85 M.cu.m (122.51 TMC) respectively from the entire Mandovi River Basin considering the area of 1523 km 2 [(2032-509) km 2], and (c) the 75% and 50% dependable annual safe yield is 1986.61 M.cu.m (70.10 TMC) and 2238.58 M.cu.m (78.99 TMC) respectively from entire Mandovi River Basin considering the area of 982 km 2 [(2032-1050) km 2]."

The water availability of entire Mahadayi basin indicated in the Issue No. 10 is as under.

- Runoff over entire catchment area of 2032 sq.km. at 75% dependability
- Runoff over entire catchment area of 2032 sq.km. at 50% dependability

791.

= 145.05 tmc

= 163.45 tmc

In the Table in Para 19 on page 8 of his Affidavit (Volume 191), Shri Chetan Pandit, Expert Witness of the State of Goa, has reported the results of his study. However while tendering his affidavit on 30.8.2016, Shri Chetan Pandit mentioned about a typing error and stated as under.

"… In the affidavit on page 8 at the bottom there is a table. In this table there is a typing error. The 75% dependable yield for an area of 2032 sq.km., is shown as

3777.3 MCM and 133.4 TMC respectively. This should read 4372.4 MCM and 154.4 TMC. These figures have been inadvertently typed in the next row. Correspondingly, the 50% dependable yield for an area of 1523 Sq. Kms. reads 4372.4 MCM and 154.4 TMC should instead read 3777.3 MCM and 133.4 TMC. An identical correction needs to be carried out in another instance of the same table at page 58 of the report, Table 34- A."

Yield reported by Shri Chetan Pandit, after incorporating the corrections suggested by him, is as under.

Yield		Mcum	tmc
Runoff over entire catchment. Area 2032 SqKm	50% Dependable	5039.8	178.0
	75% Dependable	4372.4	154.4
Usable Yield. Catchment Area	50% Dependable	3777.3	133.4

1523 SqKm	75% Dependable	3277.2	115.7

792.

However, during the course of cross examination, Shri Chetan Pandit, Expert Witness of the State of Goa in reply to question No. 154 put to him by the Tribunal on 5.10.2016 and replied by him on 6.10.2016, admitted that due to some software

1314

errors found in the 2003 version of Microsoft Office, the values indicated in his Affidavit of evidence filed on 4.8.2016 (Volume 191) needed corrections, and accordingly, during reply to question No. 154, he informed on 6.10.2016 that the reassessed values of the water availability for the entire Mahadayi basin, with catchment area of 2032 sq.km were as under.

- Runoff over entire catchment area of 2032 sq.km. at 75% dependability = 151.47 tmc
- Runoff over entire catchment area of 2032 sq.km. at 50% dependability = 175.16 tmc

Water Availability Estimated by the State of Karnataka

793.

The State of Karnataka, in its Statement of Claims (Volume 129), has referred to the water availability assessed by Central Water Commission and the following has been stated at

Para 9.2, page 76, Volume 129.

“… The total yield of Mahadayi upto the mouth of the river worked out in the CWC Report of 2003 is 6234

1315

Mcum (220 tmc) at 50% dependability and 5652 Mcum (199.60 tmc) at 75% dependability. …"

Accordingly, as per the suggestions of the State of Karnataka, the Issue No. 34 was framed for determination as under.

"Whether the State of Karnataka establishes that the total available water for allocation amongst the basin States in the inter-State river Mahadayi and its valley is not less than 220 tmc at 50% dependability or 199.6 tmc at 75% dependability as estimated by the Central Water Commission in its reports of October 2001 and March 2003?"

794.

As per Table-11, page 49 of the Report dated 12.9.2015 (Volume 166) of Prof. A. K. Gosain, Expert Witness of the State of Karnataka, the water availability of the Mahadayi basin is estimated as under.

Case I: Computation of annual yield series of Mahadayi basin for the period from 1928-29 to 2012-13 with regression	Water availability at 75% dependability	=	204.24 tmc

equation used in CWC's Report of March 2003	Water availability at 50% dependability	=	224.61 tmc

Case II: Computation of annual yield series of Mahadayi basin for the period from 1928-29 to 2012-13 using revised regression equation based on extended runoff data.	Water availability at 75% dependability	=	206.14 tmc
	Water availability at 50% dependability	=	223.20 tmc

795.

As per Table-4, page 10 of the Report dated 9.5.2017 (Volume 198) of Prof. A. K. Gosain, Expert Witness of the State of Karnataka, the water availability of the Mahadayi basin is re-assessed as under.

Case I: Computation of annual yield series of Mahadayi basin by substituting the catchment rainfall (mm) for the monsoon period for the period from 1928-29 to 2000- 01 in the best fit R-R relation	Water availability at 75% dependability	=	198.42 tmc
	Water availability at 50% dependability	=	215.59 tmc
Case II: Computation of annual yield series of Mahadayi basin by	Water availability at 75% dependability	=	202.55 tmc

substituting the catchment rainfall (mm) for the monsoon period for the period from 1928-29 to 2012- 13 in the best fit R-R relation	Water availability at 50% dependability	=	216.89 tmc

1317

796.

Prof. A. K. Gosain, Expert Witness of the State of Karnataka on 18.5.2017 before the start of his cross examination, further stated that he had worked out the water yield by using the R-R relationship derived after incorporating the omitted rainfall and runoff data of 1979-80, and the re-computed values of the water availability of the Mahadayi basin were as under.

- Water availability at 75% dependability = 223.06 tmc
- Water availability at 50% dependability = 206.17 tmc

Water Availability Estimated by the State of Maharashtra

797.

Issue No. 55 has been framed for determination in respect of the water availability on the suggestions of the State of Maharashtra. The Issue No. 55 is reproduced hereunder.

“Whether the State of Maharashtra proves that the

contribution of Maharashtra territories to the basin flow of Mahadayi river is 200.006 Mcum at 50% dependability and 171.891 Mcum at 75% dependability.”

1318

798.

Specific values of water availability either at 75% dependability or at 50% dependability for the entire Mahadayi basin have not been indicated in the Statement of Case filed by the State of Maharashtra.

799.

Shri S. N. Huddar, Expert Witness of the State of Maharashtra has, however, examined the water availability for the Mandovi (Mahadayi) basin assessed by the various Experts and reported by them in different documents, and mentioned that the specific yield revealed by CWC study is justified. In addition, he has proposed to account for the import of water from Tillari (Chapora) basin through Tillari Irrigation Project. He has mentioned in Para 4.6, page 21 of Affidavit filed on 15.9.2015 [Volume 163(a)] that taking into account this water import, he has assessed “the availability in Mandovi basin as 5913 Mcum at 75% dependability”. The water availability of 5913 Mcum at 75% dependability is equal to 208.73 tmc.

1319

Highly Varying Estimates of Water Availability by Various Experts

800.

The quantum of water availability assessed and included in different Reports varies considerably. The water availability at 75% dependability for the entire Mahadayi basin with catchment area of 2032 sq.km. as indicated in different Reports filed by the respective State Governments or by the Expert Witnesses are as under:

Sl. No.	Sources	Water Availability at 75% Dependability
1.	Affidavit of Shri S. N. Huddar, Expert :	208.73 tmc

Witness of the State of Maharashtra

(Ref: Para 799 above)

Statement of Prof. A. K. Gosain during :

cross examination (Ref: Para 796

above)

Report of Prof. Gosain of September :

2015 (Ref: Para 794 above) – Case II

Report of Prof. Gosain of September :

2015 (Ref: Para 794 above) – Case I

Report of Prof. Gosain of May 2017 :

(Ref: Para 795 above) Case II

2.

206.17 tmc

3.

4.

5.

206.14 tmc

204.24 tmc

202.55 tmc

1320

6.

7.

8.

9

Statement of Claims of the State of :

Karnataka (Ref: Para 793 above)

Report of Prof. Gosain of May 2017 :

(Ref: Para 795 above) Case I

Affidavit of Shri Chetan Pandit (Ref: :

Para 791 above)

Statement of Shri Chetan Pandit during :

cross examination (Ref: Para 792

above)

199.60 tmc

198.42 tmc

154.40 tmc

151.47 tmc

10. Statement of Case of the State of Goa :

(Ref: Para 790 above)

145.05 tmc

801.

The State of Maharashtra has not indicated the water availability for the Mahadayi basin as a whole, in its pleading. However, Shri S. N. Huddar, Expert Witness on behalf of the State of Maharashtra has mentioned the water availability for the entire Mahadayi river basin as 208.73 tmc at Para 6.0 on page 25 of his Affidavit filed on 15.9.2015 [Volume 163(a)]. In addition to above, Shri Subrai T. Nadkarni, Expert on behalf of the State of Goa has also undertaken sub-basin wise hydrological studies and included the result in his Report of November 2017 (Volume 208).

1321

802.

In view of highly varying values of water availability mentioned in different Reports, the Tribunal has decided to critically examine the following Reports.

- Reportof Central Water Commission of 2003 (Volume 15)
- Reportsof Prof. A. K. Gosain of September 2015 (Volume 66) and May 2017 (Volume 198 and Volume 198A)
- Reportof Shri Chetan Pandit of August 2016 (Volume 191)
- Reportof Shri S. N. Huddar of September 2015 [Volume 163(a)]
- Reportof Shri Subrai T. Nadkarni of November 2017 (Volume 208)

Critical Examination of Report of Central Water Commission of 2003 (Volume 15)

803.

As already mentioned earlier, the Tribunal has no hesitation in holding that the Central Water Commission Report of March, 2003 (Volume 15) cannot be said to be a Report of the CWC. The Report has been examined from the view point of its

technical contents only. The Tribunal notices that the findings of the Report of Central Water Commission of 2003 (Volume 15) were adopted by the State of Karnataka and these findings

formed the basis for its claims in respect of water availability of entire Mahadayi basin. It is also noticed by the Tribunal that Prof. A. K. Gosain, Expert Witness of the State of Karnataka, has endorsed the Report of the CWC of 2003, (Volume 15) and that the Report of Prof Gosain of September 2015 (Volume 166) is based on the methodology adopted by CWC for preparation of its Report of 2003 with additional data for the period from 1998-99 to 2012-13. This is apparent from the averments made by Prof. Gosain at Para 6, page 5 of his Affidavit filed on 15.9.2015 (Volume 166) which is reproduced as under:

"… The present study aims at assessing the annual gross yield of Mahadayi basin on 75% and 50% dependability basis taking into account the additional hydrological and meteorological data that has become available after the CWC study was conducted in 2003 and using the standard procedures and methodologies deployed by CWC."

804.

The State of Goa, in its Statement of Case (Volume

131), has raised several objections against the Report of CWC of 2003 at Paras 179B to 179D(i). The State of Goa has also highlighted a number of deficiencies in respect of data processing and methodology adopted in the Report of CWC of 2003 at Paras 179I to 179M of its Statement of Case (Volume 131).

1323

805.

Accordingly, the Tribunal has critically examined the contents of the Report of the CWC of 2003 (Volume 15), keeping in view the available information from the Statement of Case of the State of Goa (Volume 131) and that from the Statement of Claims of the State of Karnataka (Volume 129) and other related documents to ascertain as to:

a. what prompted CWC to take up the Study and finalize the Report of 2003;

b. whether the objectives of the CWC Study have been achieved;

c. whether the objections raised by the State of Goa in respect of data and procedures adopted by CWC are valid; and

d. whether the findings of CWC Study of 2003 (Volume 15) can be relied upon?

806.

From the averments made by the State of Goa at Para 87, page 117 of its Statement of Case (Volume 131) and the State of Karnataka at Para 2.19, page 22 of its Statement of Claims

(Volume 129), it is apparent that the process of undertaking the hydrological study of Mahadayi basin was initiated during the first inter-State meeting held under the Chairmanship of Member

(WP&P), CWC, on 29.5.2001 which was, among others, attended by the Secretary, Government of Goa, Secretary, Government of Karnataka and Secretary, Government of Maharashtra. One of the decisions taken during the meeting was to set up the "Hydrological Study Group" comprising the Chief Engin eer, Hydrology Studies Organization, CWC, representatives from the States of Goa, Karnataka and Maharashtra and a representative of National Water Development Agency (NWDA). It was decided that the Hydrology Study Group would submit its report in three mon ths' time.

807.

The first meeting of the Study Group under the chairmanship of Chief Engineer (Hydrology), CWC, New Delhi was held on 13.10.2001 at the Office of the Chief Engineer, WRD, Government of Goa, Panaji, Goa. In terms of the decision at the first Interstate meeting of 29.5.2001, it was agreed that the Interstate Study Group had to submit a Report. The Chief Engineer (Hydrology), CWC, who was the Chairman of the Study Group, did not even convene any meeting of the Interstate Study

Group, much less or call for any Report. Rather, at this meeting, the Chief Engineer, CWC produced a Yield Study Report unilaterally prepared by its Hydrology Directorate, ignoring

entirely the previous decision of involving Interstate Study Group. The minutes of the first meeting of the Study Group held on 13.10.2001 were circulated vide letter dated 22.10.2001. After the receipt of the minutes of the first meeting of the Study Group, the Govt. of Goa had sent detailed comments on the unilateral study carried out by CWC vide letter dated 12.11.2001 addressed to Shri V. R. Sastry, Chief Engineer, HSO, CWC, New Delhi. A similar letter dated 13.11.2001 was also sent to Shri. S. B. Suri, Chief Engineer (HQ), NWDA, New Delhi . Inresponse to the letter dated 13.11.2001, clarifications were received by the State of Goa from the NWDA vide their letter dated 4.1.2002 . Further, the Government of Goa requested NWDA to supply the full and correct data vide letter dated 18.1.2002.

808.

The second meeting of the Hydrological Study Group for the yield of Madei river basin was held on 11.1.2002 at Bengaluru, which was intimated by letter, dated 12.12.2001 enclosing agenda for the meeting . Thenotes were circulated by Goa in the second meeting of the Study Group at Bangalore . The

following paragraphs give the outcome of the discussions which took place in the second meeting of the Hydrology Study Group.

1326

i.

Director, Hydrology (S) requested the members to identify the rain gauge stations, which the co-basin states propose to be considered in the study. During the discussions in the first meeting, Government of Goa was of the view to consider only IMD stations. Govt. of Goa now confirmed their view that all the stations for which data is available irrespective of the agency who is maintaining the station is to be used in the analysis. Other members also agreed for the same. While raising the issue of influencing area of each stations, Director, Hydrology (S) wanted to know if certain stations below some threshold influencing area could be neglected.

ii.

While discussing about the authentication of hydro-meteorological data to be used in the study, Chief Engineer, Govt. of Goa, expressed the following concerns.

(a) The rainfall data for some years and some stations, which they have got directly from IMD, do not match with

what has been used in the preliminary study by CWC.

(b) The discharge data at Ganjim is not consistent. The discharge varies significantly for the same gauge level.

iii.

After discussing the approach to be applied to the study, it was decided that rainfall – runoff model at Ganjim can be

developed once the rainfall data and discharge data are reconciled and corrected, considering all the stations up to Ganjim.

iv.

While discussing about the period for which the rainfall data is to be used for extending the rainfall-runoff model, CWC in its preliminary studies has proposed to consider the period from 1931 onwards as most of the rainfall stations were operative in this period, which give a more rational catchment rainfall value. Seventy years is sufficiently good length of series to finalize the yield studies. Government of Karnataka agreed to this proposition. However, Government of Goa insisted to consider the data for the entire period i.e., 1901 onwards irrespective of the number

of stations and their period. After detailed discussion, no consensus among the participating states could be reached on the period of data to be used for developing the series. It was therefore decided that this would be discussed in the next meeting.

809.

Before the Study Group could even complete the yield study, the CWC summoned the second Interstate meeting on 7.3.2002 vide letter dated 15.02.2002. However, from the

minutes of the meeting circulated vide letter dated 16.4.2002, it is evident that the meeting was actually held on 27.3.2002. The notes were circulated by Goa Team in the second inter-state meeting at New Delhi. The minutes of the second inter-state Meeting are indicated in para 36(xc) of Volume II.

810.

An inter-State meeting was convened by the Union Minister of Water Resources on 20.12.2002. The meeting was attended by the Chief Minister of Goa, Minster of Major and Medium Irrigation from Karnataka among others. It was decided that the yield study should be completed by 31.3.2003, after reconciliation of the discrepancies by the officials of the Government of Goa and CWC.

811.

In pursuance to the decision taken during the meeting taken by the Union Minister of Water Resources on 20.12.2002, the CWC, vide letter dated 6.3.2003 (Annex. III, page 16, Volume 15) requested the States of Goa, Karnataka and Maharashtra to depute the representatives of respective States to CWC. The CWC

proposed to start the work on 10.3.2003 and informed the States that the analyses might take about 15 days.

1329

812.

CWC informed that the representatives of the NWDA and the States of Karnataka and Goa attended Central Water Commission, but the State of Maharashtra did not respond. However, CWC also reported that the representative of Goa initially attended the meeting but later on withdrew and conveyed his reservation on correctness of rainfall and discharge data and suggested for postponing the yield studies till apprehensions were allayed.

813.

However, the study report titled “Study on Yield of Mahadayi Basin” was drafted in CWC in March 2003 by the Study Group consisting of members from NWDA and State of Karnataka only. Thereafter, the report was submitted to the Ministry of Water Resources by the Chairman, CWC on 10.4.2003. The Union Ministry of Water Resources, after examining the matter, directed CWC to convince Government of Goa about the data collection procedure in view of the restrictions placed by Ministry of Water Resources for supply of raw data; and to call further

meeting of the engineers of the two States (i.e., Goa and Karnataka), to reach an agreement on the studies done by CWC. The record does not indicate that any steps were taken by the CWC pursuant to directions given by the Ministry of Water

1330

Resources nor there is anything on record to show that any meeting of the engineers of the two States, was convened by the CWC or that any agreement was reached, regarding study done by CWC, between Goa and Karnataka. Thus, the studies carried out by CWC in March 2003 remained inconclusive and incomplete. In view of above, it is evident that the report titled “Study on Yield of Mahadayi River Basin” of the Central Water Commission (Volume 15) was never considered by the Hydrology Study Group. Further, there is nothing on record to establish that the said Study has been considered during the subsequent inter-State meetings. It is also evident that the Ministry of Water Resources has also not accepted or adopted the said Study. In view of what is stated above, the Tribunal is of the opinion that there is no CWC Report (2003) and Volume 15 produced by the State of Karnataka cannot be taken into consideration as the report of the Central Water Commission, prepared in the year 2003.

814.

The Tribunal notes that there is nothing on record

which mentions about objective of the preparation of the Report of CWC of 2003. It is noted that the only action on part of the Union Ministry of Water Resources was to issue the letter dated

1331

30.4.2002 (Annexure- 24, pages 101-102 of Volume 11) to convey the in-principle clearance from water availability angle to the Government of Karnataka for diversion of 7.56 tmc from Madei basin to meet the drinking water needs of Hubli / Dharwad. Subsequently, the letter dated 30.4.2002 was kept in abeyance by the Union Ministry of Water Resources vide letter dated 19.9.2002 (Annexure-25, pages 103-104, Volume 11). The Tribunal notes that the specific action on part of the Union Ministry of Water Resources i.e., issuing the letter conveying the in-principle clearance and subsequently keeping the in-principle clearance in abeyance, was much before the drafting of the Report of CWC of 2003 and forwarding the same to the Ministry of Water Resources on 10.4.2003.

815.

The Tribunal notices that, in this regard, following important points emerge.

a. The “Study on Yield of Mahadayi River basin” finalized by the Central Water Commission has not been formally considered by the “Hydrology Study Group”. There is

nothing on record which establishes that the “Hydrology Study Group” has applied its mind on the “Study on Yield of

Mahadayi River basin" drafted by the Central Water Commission and adopted, affirmed, agreed to, concurred with, recognized or acknowledged the same.

b. There is nothing on record to establish that the said study has been considered during subsequent Inter-State meetings, either at the level of Member (WP&P), CWC or at the level of Union Minister of Water Resources.

c. There is nothing on record which establishes that the said study has been adopted by the Union Ministry of Water Resources for any purpose.

816.

The Tribunal is of the firm view that neither the State of Karnataka nor the State of Maharashtra, is justified in treating such an inconclusive and incomplete report as that of CWC (2003) Report. Further, the Tribunal holds that different projections of water availability, made by the State of Karnataka and State of Maharashtra as well as by their respective Expert witnesses, on the basis of so called CWC (2003) report, which in fact, is not the report of CWC, in the eye of the law at all, are

uncalled for and unwarranted and therefore, the same cannot be considered, by the Tribunal.

1333

817.

Four specific objections of the State of Goa, on the data used by CWC for the preparation of the Report and the methodology adopted by it, are at Paras 179B, 179C, 179D and 179D(i) of its Statement of Case (Volume 131). In addition, few other deficiencies have also been highlighted in paras 179I to 179M.

818.

The Tribunal finds that the Objection 1 at Para 179B at pages 212 and 213 (Volume 131) relates to exclusion of rainfall data of Panaji Station from the year 1901 to 1927. However, it was noted that Shri Chetan Pandit, the Expert Witness of the State of Goa, himself has not used the data of Panjim Station from 1901 to 1927 in his study (Volume 191). As a matter of fact, Shri Chetan Pandit has used the data of various rain gauge stations including that of Panjim for the period from 1964 to 2005 only for the purpose of estimation of water availability. Therefore, this objection raised by State of Goa, has no substance.

819.

It is noted by the Tribunal that the Objection 2 at Para 179C, pages 213 and 214 (Volume 131) pertains to use of runoff data based on discharge measurement at Ganjim Site by ‘float

observation method'. It is, howev er, noted that Shri Pandit has himself used the same data i.e., discharge data observed by CWC using 'float observation method' after applying certain corrections, although on an erroneous assumption. This aspect has been discussed in detail while dealing with the Issue No. 6 framed for determination. Thus the objections to CWC (2003) report raised in Para 179C has also, no substance.

820.

The objection 3 at Para 179D, pages 214 to 216 (Volume 131) raised by the State of Goa relates to non-exclusion of an area of 1050 sq.km. from the total catchment area of 2032 sq.km. of Mahadayi basin for the purpose of determination of 75% and 50% dependable yield. It is, however, noticed by the Tribunal that subsequently at Para 179N, page 222 (Volume 131), the State of Goa has mentioned that a Report of IIT, Bombay has assessed the catchment area to be excluded as 501 sq.km., and not 1050 sq.km as mentioned at Para 179D. The Tribunal notices that on the other hand, Shri Chetan Pandit, in his Report of August 2016 (Vol 191), has considered 509 sq.km. as

the area to be deducted. This aspect of exclusion of an area of 509 sq.km. has already been discussed at paras 3 to 15 and the Tribunal is of the considered view that for the purpose of

assessment of water availability or yield of the Mahadayi basin, total catchment area of 2032 sq.km. should be taken. Therefore, the objection does not sustain.

821.

The objection 4 at Para 179D (i) at page 217 (Volume 131) relates to errors in derivation of regression equation by CWC. In this regard, a similar question was put to Prof. A. K. Gosain, by the State of Goa, in respect of regression equation derived by Prof. Gosain by using the additional data. In reply to the question No. 187 put to Prof. Gosain by the learned Senior Counsel of the State of Goa on 17.5.2017, he replied as under:

“While deriving the regression equation, it is always important to understand the other conditions also. In the question No. 181 posed to me yesterday, I was told that Goa had achieved a runoff equation as below:-

Runoff = 0.625 * Rainfall + 1278.113

When I used this equation to derive the Mahadayi yield, as per the procedure and data used in CWC (2003) Report, I got a yield of 238.69 TMC at 75% dependability

and 273.38 TMC at 50% dependability, which is drastically different from the yield obtained by CWC (2003) Report. I believe Goa has ignored a very important line provided in CWC (2003) Report, at pages 9-10. I quote:-

‘Regression analysis has been carried out using the monsoon catchment rainfall and concurrent runoff and best fit R-R relation obtained, ignoring

inconsistent data of monsoon rainfall / runoff points as per standard practice'.

Therefore, if you do not use the proper information, while deriving the R-R relation, you are bound to get different equations. As far as my above referred equation is concerned, it has been derived by ignoring all the years with the runoff factor more than 1.0."

822.

In view of above, the specific objection i.e., Objection 4 of the State of Goa does not sustain in its present form, However, the issue relating to ignoring specific data sets while deriving the rainfall runoff equation has been examined separately in subsequent Paras.

823.

Even if, one assumes, for the sake of argument, that there is a CWC (2003) report, as contended by the State of Karnataka and State of Maharashtra, as well as by their respective Expert witnesses, there are serious deficiencies, drawbacks, anomalies, shortcoming, inconsistencies, in the data

and processing of data, used in CWC (2003) Report, which are enumerated by the Tribunal as under.

a. The Central Water Commission, in its Report on "Consistency Analysis of Flow Data in Mahadayi Basin" (Vo l

1337

99) has concluded at Para 5.0, page 17 that ‘the flow data of Ganjim G&D site appears to be consistent and homogeneous and reliable for any water availability analysis / estimate in basin’. However, it is found by the Tribunal that for the purpose of derivation of Rainfall-Runoff equation in its Report of 2003 (Volume 15), CWC chose to ignore the data of 9 years out of total length of data of 19 years, which were available at the time of preparation of the Report, as is apparent from “Note on Inconsistency in the Process of Exclusion of Data Used for Development of Rainfall Runoff Relations as Adopted in the Report (2003) of CWC and the Report of September 2015 of

Prof. A. K. Gosain", prepared by the Tribunal and shown to

Prof. Gosain as MARK-19. The Note is reproduced

hereunder:

"On the basis of limited preliminary analysis (using trial and error approach) of

data included in the studies carried out by CWC [Annexure-29 of the Statement

of Claims on behalf of the State of Karnataka] and the information provided by

Prof. A. K. Gosain vide Exhibit KAR/RW-1/7, the following position emerges.

Sl. No.	Year	Runoff factor	Information about exclusion of data in		Remarks
			CWC's 2003 Report using 19 years of data	Prof. Gosain's Report using 34 years of data	
1	2	3	4	5	6
1.	1980	1.35	Excluded	Excluded	
2.	1982	1.30	Excluded	Excluded	

3.	1988	1.11	Excluded	Excluded	
4.	2011	1.11	-	Excluded	Data for 2011 not used by CWC
5.	1984	1.09	Excluded	Excluded	
6.	1999	1.05	-	Excluded	Data for 1999 not used by CWC
7.	1990	1.02	Excluded	Excluded	
7.	1983	1.01	Excluded	Excluded	
8.	1995	0.98	Excluded	Not excluded	
9.	1981	0.97	Excluded	Not excluded	
10.	1996	0.61	Excluded	Not excluded	
11.	2006	0.58	-	Excluded	Data for 2006 not used by

					CWC

From above, it is apparent that CWC excluded data set of 9 years for the study

to develop linear regression equations. It is noted that the data excluded by

CWC inter-alia included the data for the years 1981, 1995 and 1996 but Prof.

Gosain, Expert Witness for the State of Karnataka did not exclude the data for

these years and considered data for these years in his study. It also appears that

data for the year 2006 with runoff factor of 0.58 has been excluded by Prof.

Gosain. Obviously, there are marked variations in the procedure followed by

CWC and that by Prof. Gosain."

The reasons, for not considering data of 9 years out of 19

years and ignoring 9 years of data for development of

Rainfall-Runoff equation, have not been fully explained by

CWC in its Report of 2003.

b. The process of filling-in the missing monthly rainfall data

with monthly normal values, stated as the 'method of

Normals' is not in conformity with prescribed procedures in

various documents. The report titled “Hydro -meteorology Handbook: Precipitation and Climate (May 2014)” prepared under Indian Hydrology Project (MARK-18, which was shown to Prof. A. K. Gosain), prescribes three methods, namely (a) Arithmetic Average method, (b) Normal Ratio method, and (c) Distance Power method, for filling up the gap. Similarly, in the publication No. UM-1/98-99 titled “Procedure for Systematic Processing of Rainfall Data” of National Institute of Hydrology (MARK-10), which was shown to Prof. Gosain), two methods namely (a) Normal Ratio method, and (b) Distance Power method, have been described.

c. The Tribunal finds that there are obvious mistakes of serious nature in computations as is evident from Annex-XI on page 46 of the Report of CWC of 2003 (Volume 15). At page 46 of Report of CWC of 2003 (Volume 15), the gross monsoon yields from the year 1979-80 to 1997-98 are shown to be increasing every year by 1 Mcum, which is not correct as is evident from the values indicated in Annex X,

page 45 of Volume 15. Similarly, the non-monsoon yield in the 3 rd column of Annex XI is found to be increasing by 1

Mcum every year which is contrary to the values indicated in column 9 of Annex IX(a), page 42 of Volume 15. Shri A. K. Bajaj, Expert Witness of the State of Karnataka, in reply to question No. 105 (xi) put to him on 18.9.2017, by the learned Senior Counsel for the State of Goa, stated as under.

“This point was answered by me sometimes back also and it was indicated at that time also that this is a typographical error that has crept in while copying / pasting data in the excel sheet from one data set to another.”

The Tribunal finds that, such justifications, for obvious errors in the computations, which have a bearing on the final outcome, are not at all acceptable, to the Tribunal at all.

d. The checks for external consistency as prescribed in the “Guidelines for Preparation of Detailed Project Reports of Irrigation and the Multipurpose Projects issued by Government of India, Ministry of Water Resources, 2010

(MARK-5) and presence of trend in the data as prescribed in the “ Guidelines for rainfall-runoff modelling – Towards best practice model application” published by eWater

1341

Cooperative Research Centre of the Australian Government. (MARK- 34) and illustrated in the “Comparison Table” prepared by the Tribunal (MARK-35) were not undertaken by CWC in its report of 2003, although these are part of prescribed procedures; and appropriate corrections to account for the trend, if significant, are necessary. Non consideration, of checks for external consistency, in fact, vitiates the CWC (2003) Report.

824.

Thus even if one assumes for the sake of argument that there is a Report of CWC of the year 2003, the Tribunal finds that it is full of inconsistencies, discrepancies, drawbacks and not prepared in accordance with principles relating to hydrology. Therefore, the Tribunal is of the opinion that the same is not a reliable piece of evidence.

Critical Examination of Report of Prof. A. K. Gosain of September 2015 (Volume 166) and May 2017 (Volume 198 and Volume 198A)

825.

During the course of cross examination of Prof.

Gosain, Expert Witness of the State of Karnataka, several

inconsistencies were noted in his analyses of the data and during

the development of the rainfall-runoff model by him. Following two major flaws, are noteworthy in his analyses.

a. Although it has been stated by CWC as well as by Prof. Gosain in his Reports that the discharge data, observed by CWC at Ganjim G&D site is consistent, data of considerable number of years are omitted for development of rainfall-runoff relation on the ground that, in such years, runoff factor is more than 1. It is also noted that reasons for such a situation, i.e., runoff factor being more than 1 in many years, are neither investigated nor explained in the concerned Report(s).

b. While developing the rainfall-runoff model, data sets of rainfall and runoff with runoff factor very close to 1 (say, 0.98, 0.97, 0.94 etc.) were, however, retained / utilized by him, without justifying the use of such data sets, in the analyses.

826.

From the above, it is apparent that necessary checks were not performed on the input data used either by CWC or by

Prof. Gosain, before attempting, the development of rainfall-

runoff model and applying the same, for assessing the water availability of Mahadayi basin.

827.

It has also been noted that there are many inconsistencies in the rainfall data and in the processing of rainfall data by Prof. Gosain. Some of these major inconsistencies are as under:

a. Prof. A. K. Gosain has used rainfall data of ten rain gauge stations, namely, Valpoi, Ponda, Panjim, Mapuca, Sanguem, Khanapur, Kankumbi, Jamagaon, Amagaon and Castlerock in his analysis, wherein, values of rainfall of some of the rain gauge stations, appended to his two Reports i.e., Report of September 2015 (Volume 166) and Report of May 2017 (Volume 198 and Volume 198A) are very different for several years as is apparent from the following Table which is marked as from MARK-26.

COMPARISON OF RAINFALL DATA (in mm) IN REPORTS OF 2015 AND 2017		
	Valpoi	Ponda

Year						
	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report
1979	3417	3640	7	2585	2736	6
1980	3934	4384	11	3376	3392	0
1981	4384	4661	6	4364	4364	0

1982	4661	4787	3	3933	3933	0
1983	4787	3957	-17	3526	3526	0
1984	3957	3648	-8	2423	2423	0
1985	3648	3104	-15	2968	2968	0
1986	3104	3465	12	1909	1909	0
1987	3465	3464	0	2933	2933	0
1988	3934	5065	29	3376	3610	7
1989	3753	3754	0	2951	2956	0
1990	4410	4410	0	3338	3339	0
1991	3560	3560	0	2726	2727	0
1992	3984	3984	0	3893	3893	0
1993	3934	5258	34	3339	3336	0

1994	3934	5974	52	3577	3477	-3
1995	3934	3786	-4	3396	3362	-1
1996	4217	3018	-28	3083	3093	0
1997	4891	3913	-20	3609	3612	0
1998	3404	3262	-4	3375	2978	-12
1999	4506	3605	-20	3540	3600	2
2000	4010	3208	-20	3290	3301	0
2001	3106	3106	0	2665	2665	0
2002	3409	3409	0	2575	2575	0
2003	3659	3659	0	3122	3122	0
2004	3152	3152	0	2527	2527	0
2005	4584	4584	0	3585	3585	0
2006	9148	7282	-20	3038	5178	70
2007	4085	4085	0	3765	3795	1

2008	6439	5021	-22	2938	3744	27
2009	3826	3826	0	3446	3446	0
2010	4943	4943	0	3909	3909	0
2011	5092	5092	0	4097	4097	0
2012	4156	4156	0	3033	3033	0
Average 1979-2012	4218	4124	-2	3241	3328	3

COMPARISON OF RAINFALL DATA (in mm) IN REPORTS OF 2015 AND 2017

Year	Panjim			Mapuca		
	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report
1979	2299	1655	-28	2874	2148	-25
1980	2572	2572	0	2874	2677	-7

1981	3228	3228	0	3553	3553	0
1982	3020	3020	0	3395	3395	0
1983	3558	3558	0	4068	4068	0

1984	2575	2575	0	2621	2621	0
1985	2852	2852	0	3002	3002	0
1986	1722	1722	0	1952	1952	0
1987	2723	2723	0	2916	2916	0
1988	3083	3093	0	2874	3220	12
1989	2613	2613	0	2874	2720	-5
1990	2230	2230	0	2756	2756	0
1991	2409	2409	0	2089	2089	0
1992	2723	2723	0	2574	2574	0
1993	2464	2464	0	2340	2340	0
1994	2845	2845	0	3006	3007	0
1995	3507	3506	0	3404	3405	0

1996	2932	2932	0	3362	3363	0
1997	3286	3286	0	3607	3607	0
1998	3010	3010	0	2874	3134	9
1999	3334	3334	0	3612	3612	0
2000	2905	2905	0	3054	3054	0
2001	1955	1955	0	2013	2013	0
2002	2196	2196	0	2254	2254	0
2003	2682	2682	0	2581	2581	0
2004	1991	1991	0	1974	1974	0
2005	2356	2356	0	3150	3150	0
2006	4431	2507	-43	4759	2610	-45
2007	3244	2932	-10	3507	3507	0
2008	2675	2893	8	2730	3012	10
2009	2943	2662	-10	3105	3105	0

2010	3787	3787	0	3938	3938	0
2011	3011	3011	0	3502	3502	0
2012	2797	2797	0	2869	2869	0
Average 1979-2012	2822	2736	-3	3002	2933	-2

COMPARISON OF RAINFALL DATA (in mm) IN REPORTS OF 2015 AND 2017

Year	Sanguem			Khanapur		
	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report
1979	3202	3202	0	1911	1838	-4
1980	3638	3678	1	1414	2146	52
1981	4460	4460	0	1973	1873	-5
1982	4183	4183	0	1435	1852	29

1983	3897	3897	0	1456	2033	40
1984	3085	3085	0	1724	1653	-4
1985	4052	4052	0	1320	1320	0
1986	2775	2775	0	1446	1446	0

1987	2797	2797	0	1169	1178	1
1988	4008	3156	-21	1610	1610	0
1989	3364	3196	-5	1333	1333	0
1990	3652	3450	-6	1577	1577	0
1991	3203	3024	-6	1857	1857	0
1992	4099	3622	-12	1906	1906	0
1993	3091	2882	-7	1957	1957	0
1994	3655	3454	-6	3044	3044	0
1995	3213	3024	-6	1283	1294	1
1996	3211	3784	18	2322	1564	-33
1997	3966	3838	-3	1356	2164	60
1998	3638	2932	-19	1463	1483	1

1999	4214	4214	0	2076	2076	0
2000	4463	4463	0	1417	1417	0
2001	3059	3059	0	1083	1083	0
2002	2637	2637	0	1143	1143	0
2003	3305	3305	0	1469	1190	-19
2004	2817	2817	0	1266	1508	19
2005	5459	3558	-35	2151	1527	-29
2006	6909	5162	-25	2056	1460	-29
2007	3192	3253	2	2654	1885	-29
2008	8533	4249	-50	1966	1966	0
2009	3932	3932	0	2819	2002	-29
2010	4596	4596	0	1984	1433	-28
2011	4384	4384	0	2044	2079	2
2012	3170	3170	0	1669	1188	-29

Average 1979-2012	3878	3567	-8	1746	1679	-4

COMPARISON OF RAINFALL DATA (in mm) IN REPORTS OF 2015 AND 2017

Year	Kankumbi			Jamagaon		
	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report
1979	5495	4396	-20	4177	4177	0
1980	5170	6292	22	3008	4688	56
1981	6712	5824	-13	4353	4354	0
1982	3822	5505	44	2942	3301	12
1983	6539	5231	-20	3054	4231	39
1984	5812	4700	-19	2942	2713	-8
1985	5103	4118	-19	4052	2356	-42

1986	3951	3161	-20	3005	3004	0
1987	4207	3365	-20	2913	2445	-16
1988	5888	4702	-20	4181	4181	0
1989	5062	4418	-13	3592	3592	0
1990	6209	4967	-20	4472	4559	2

1991	7187	4393	-39	4426	4426	0
1992	6640	4803	-28	3830	3836	0
1993	6323	5327	-16	4602	4111	-11
1994	10205	6445	-37	8522	6064	-29
1995	5250	3945	-25	2299	2905	26
1996	7409	4140	-44	5378	3694	-31
1997	6650	6595	-1	4713	4676	-1
1998	5700	5700	0	3211	2264	-29
1999	6575	6576	0	3763	3803	1
2000	5382	5382	0	3181	3378	6
2001	4430	4430	0	2808	2808	0
2002	4579	4579	0	2669	2669	0

2003	5227	4549	-13	3494	3462	-1
2004	4504	5543	23	3010	3833	27
2005	6973	6973	0	5379	5379	0
2006	7414	7414	0	5700	5700	0
2007	6425	6425	0	5115	5115	0
2008	5362	5362	0	4307	4307	0
2009	5389	5389	0	3538	3538	0
2010	7062	6279	-11	4720	3985	-16
2011	7275	7363	1	4863	5046	4
2012	5938	5094	-14	3969	2971	-25
Average 1979-2012	5937	5276	-11	4006	3870	-3

COMPARISON OF RAINFALL DATA (in mm) IN REPORTS OF 2015 AND 2017

	Amagaon	Castlerock

Year						
	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report	As per Report of 2015	As per Report of 2017	Variation w.r.t 2015 Report
1979	4011	5395	35	2695	7734	187
1980	3511	5657	61	2232	6934	211
1981	4793	5278	10	3335	6319	89
1982	3077	6052	97	2036	6643	226
1983	4157	5518	33	2492	6675	168
1984	3332	6236	87	2300	5605	144
1985	3755	5438	45	1977	5144	160
1986	3755	4970	32	1931	5115	165
1987	2491	4383	76	2452	4723	93
1988	3755	6679	78	2317	6868	196
1989	3313	5065	53	1965	5181	164

1990	4397	6249	42	2816	7054	150
1991	4323	5981	38	2712	5907	118
1992	4536	5763	27	2850	5809	104

1993	4636	6678	44	3458	5949	72
1994	7107	9041	27	4835	8264	71
1995	2854	4873	71	2014	5149	156
1996	4590	5222	14	3258	5197	60
1997	5082	6447	27	3455	6273	82
1998	3734	7526	102	1708	4860	185
1999	3756	8638	130	3003	6769	125
2000	3935	5085	29	2338	5454	133
2001	5343	5343	0	5305	5305	0
2002	4823	4823	0	4860	4860	0
2003	3607	4738	31	4854	4854	0
2004	3108	6182	99	5848	5848	0

2005	8006	8006	0	7486	7486	0
2006	10489	10489	0	7380	7380	0
2007	7864	7864	0	5044	5044	0
2008	6216	6216	0	5883	5883	0
2009	6623	6623	0	5565	5565	0
2010	4873	10051	106	5330	5465	3
2011	5020	9502	89	6305	6931	10
2012	4098	5762	41	5087	5358	5
Average 1979-2012	4676	6405	37	3739	5988	60

b. The Tribunal finds that, in particular, the data of rain gauge station at Castlerock appended to different reports filed by the State of Karnataka, including the two reports of Prof. A. K. Gosain, viz., the Report of September 2015 (Volume 166) and the Report of May 2017 (Volume 198 and Volume 198A) have large variations, as is apparent from the following Table which is marked as MARK-27.

COMPARISON OF RAINFALL DATA OF CASTLEROCK (in mm) USED FOR ANALYSIS IN DIFFERENT REPORTS						
Year	Annex - V(xv), Page 32 of CWC Report of 2003 (Vol 15)	Annex - VI, Page 33 of CWC Report of 2003 (Vol. 15)	Data of Station maintained by IMD, Annexure - C (Colly), page 63 of Vol. 98 filed on 1.12.2014	Data of Station maintained by WRD, Karnataka, Annexure - D (Colly), page 69 of Vol. 98 filed	Annexure-IV, page 61 to 63 of Report of September 2015 of Prof. Gosain (Vol.166)	Annexure IV, Pages 77 to 79 of Report of May 2017 of Prof. Gosain (Vol.198)

				on 1.12.2014		
1962				6732		
1963				3137		
1964	2553.4	1772	2553	6453	1772	6920
1965	1992.9	1251	1993	4107	1251	5401
1966	2578.0	1878	2578	3691	1878	7005
1967	210.0	2270	209	5869	2270	4554
1968	1932.4	692	1932	5994	692	5237
1969	2335.0	1610	2335	5920	1610	6328
1970	2491.5	1698	2492	6634	1698	6752
1971	1553.7	1551	1553	4907	1554	4211
1972	2103.9	1048	2104	4678	1048	5702

1973	2176.6	854	2177	5291	854	6359
1974	2026.9	1864	2028	13145	1864	5493
1975	2547.4	1257	2548	6119	1257	6903
1976	2036.1	2211	2036	4725	2211	5518
1977	1952.9	1629	1953	5968	1629	5292
1978	2736.6	2737	2736	7788	2737	7416
1979	2854.0	2695	2854	5713	2695	7734
1980		2232		6534	2232	6934
1981	3335.1	3335	6320	6275	3335	6319
1982		2036	6644	6641	2036	6643
1983	2492.3	2492	6675	6675	2492	6675
1984	2300.0	2300	5605	5605	2300	5605
1985	1976.7	1977	5144	5144	1977	5144
1986	1931.3	1931	5116	5116	1931	5115

1987		2452	4722	4722	2452	4723
1988	2316.7	2317	6869	6869	2317	6868
1989	1965.2	1965	5182	5181	1965	5181
1990	2815.7	2816	7055	7055	2816	7054
1991	2711.6	2712	5906	5917	2712	5907
1992	2849.6	2850	5810	5810	2850	5809
1993	2275.6	3458	5948	5948	3458	5949
1994	4160.3	4835	8265	8265	4835	8264
1995	1405.3	2014	5149	5149	2014	5149
1996	2300.6	3258	5198	5229	3258	5197
1997	2728.3	3455	6272	6182	3455	6273
1998	1920.5	1708	4861	4815	1708	4860
1999	2714.5	3003	6770	6787	3003	6769

2000	2337.6	2338	5454	5454	2338	5454
2001	2143.0		5305	5308	5305	5305
2002			4861	4862	4860	4860
2003			4854	4854	4854	4854
2004				5848	5848	5848
2005				7494	7486	7486
2006					7380	7380
2007					5044	5044

1350

2008					5883	5883
2009					5565	5565
2010					5330	5465
2011					6305	6931
2012					5087	5358
Av. of all data	**2307**	**2230**	**4309**	**5923**	**3091**	**5973**
Av. of data upto 1979	**2130**	**1689**	**2130**	**5937**	**1689**	**6052**
Av. of data after 1980	**2457**	**2642**	**5825**	**5913**	**3771**	**5935**

c. At Para 3(ii) on page 21 of his Report of September 2015

(Volume 166), Prof. A. K. Gosain stated that rainfall data of rain gauge Stations in and around Mahadayi basin collected / supplied by IMD were used in the analysis. It is noted that restricting the choice of rain gauge stations whose data were collected / supplied by IMD is contrary to the decision taken during the second meeting of Hydrology Study Group held on 11.1.2002, which are reproduced hereunder.

"…

(i) Director, Hydrology (S) requested the members to identify the rain gauge stations, which the co-basin states propose to be considered in the study. During the discussions in the first meeting, Government of Goa was of the view to consider only IMD stations. Govt. of Goa now confirmed their view that all the stations for which data is available irrespective of the agency who is maintaining the station is to be used in the

analysis. Other members also agreed for the same. While raising the issue of influencing area of each stations, Director, Hydrology (S) wanted to know if certain station below some threshold influencing area could be neglected.

…

(iii) After discussing the approach to be applied to the study, it was decided that rainfall – runoff model at Ganjim can be developed once the rainfall data and discharge data are reconciled and corrected, considering all the stations up to Ganjim.

…"

The reasons for not adhering to the decisions taken by the Hydrology Study Group have not been indicated either in the CWC (2003) Report (Volume 15) or by Prof. Gosain in his Report of September 2015 (Volume 166)

d. Further, different procedures, namely (a) Arithmetic Average method, (b) Normal Ratio method, and (c) Distance

Power method have been adopted for filling-in the missing rainfall data by Prof. A. K. Gosain in his Report of September 2015 (Volume 166) and in the Report of May 2017 (Volume 198 and Volume 198A), without clearly justifying the reasons for adopting different procedures.

e. Thiessen Polygon Method has been used for estimating the average rainfall over the entire basin or the basin up to Ganjim site. However, for estimating the average rainfall, over the catchment area up to the various project sites, in State of Karnataka, the rainfall of a rain gauge station or the mean of two or three rain gauge stations by 'Arithmetic Mean Method' has been u sed for estimating average rainfall over the catchment area up to the project sites, as is apparent from Table 1 on page 12, Table 5 on page 16, Table 9 on page 20 and Table 10 on page 21 of Additional Affidavit of Prof. A. K. Gosain filed on 15.11.2016 (Volume 193). It is noted by the Tribunal that the reasons for selecting specific rain gauge Station or Stations for estimating the average rainfall over the catchment up to the project sites have not been explained and / or offered by Prof. Gosain.

f. Simila rly, the reason for using 'observed runoff' at Ganjim, has not been explained. This is more so, in view of the fact that Prof. Gosain has chosen to ignore runoff data of 9 years

out of 34 years, observed at Ganjim for development of rainfall runoff equation. It is also observed that Prof. Gosain

1353

in his Report of November 2016 filed on 15.11.2016 (Volume 193), has used the observed runoff data of Collem gauging site for estimation of water availability at 75% dependability for two project sites, namely, Katla-Palna dam and Diggi diversion. It is, however, noted that Prof. Gosain at Para 5.1.1.4 on page 29 of his Report of September 2015 (Volume 166), has concluded that “the test shows a mixed response to the consistency checks of the flow series of Collem, therefore the station has not been used further for any detailed assessment of the basin water yield”. Prof. Gosain has not explained as to why he chose to use the data of Collem gauging site for estimation of water availability at 75% dependability for two project sites namely, Katla-Palna dam and Diggi diversion, when he had already decided not to use this data further.

828.

In

view

of

above
mentioned
drawbacks,
inconsistencies etc., it is apparent that the data, the analysis of data and the results thereof, included in the Report of September 2015 of Prof. Gosain (Volume 166) and that of May 2017 (Volume 198 and 198A) cannot be accepted or relied upon by the Tribunal.

1354

Critical Examination of Report of Shri Chetan Pandit of August 2016 (Volume 191)

829.

It emerges from question No. 20 put to Shri Chetan Pandit, Expert Witness of the State of Goa, by the Tribunal that there are several instances of inconsistencies in the rainfall data used by him. The question No. 20 and answer thereof are reproduced hereunder.

“Q. No. 20. As per the title of the Table -2, page 15 of the Additional Affidavit filed by you on 4.1.2017, the table contains “Annual Rainfall at Stations used in the present study [Taken from the Table 31, page 90, of Document 191]. On examination of the content of the Table 31, page 90 of the Document 191, it is found that it contains the monsoon rainfall of various rain gauge stations and not the annual rainfall and that the same has been shown as annual rainfall in the Table-2 of the Additional Affidavit. This needs to be corrected. The monsoon rainfall data of some of the rain gauge

stations are included in other documents filed by the State of Goa, particularly in the “Report by the Panel of Experts” at A nnexure 120 of the Document No. 31. Examination of the monsoon rainfall data provided in Annexure 12 of the Document No. 31 and that in Document No. 196 indicates that there are considerable variations in the monsoon rainfall in respect of some of

the years. A statement indicating the variation is

enclosed. Some of the notable variations are as under:-

i.

ii.

iii.

iv.

v.

vi.

vii.

viii.

Data of Valpoi used by you for the year 1971 is

about 62% less;

Data of Valpoi used by you for the year 1972 is

about 63% less;

Data of Sanguem used by you for the year 1971 is

about 67% less

Data of Sanguem used by you for the year 1972 is

about 63% less;

Data of Kankumbi used by you for the year 1964 is

about 151% less;

Data of Kankumbi used by you for the year 1965 is

about 166% less;

Data of Amagaon used by you for the year 1977 is

about 42% less;

There are considerable variations in almost all the

years in case of Chapoli. Apparently, there is

shift in the rainfall values by one year.

In this regard, please answer the following:-

a. What are the reasons for such variations in respect

of the rainfall data included in the two documents

filed by the State of Goa?

b. Don’t you feel that reduction in the monsoon

rainfall of such a high magnitude even in one or

two years has potential of assessment of water

availability on lower side and particularly in case of

assessment of water availability at 75%

dependability?

1356

Ans. The title of the Table 2 on page 15, should be annual monsoon rainfall and not the annual rainfall. The word monsoon is omitted which is a typographical error.

a) As regards the variation in the rainfall data for certain stations, as used by me and in the “Report BY THE PANEL OF EXPERTS”, the source of the data used by the Panel of Experts in 1999 study is not known to me. However, I have reasons to believe that there were some discrepancies in the data used by various agencies before 2003. If one refers to the CWC report of 2003, which is marked Annexure 29 (Vol. 15) (Exh. KAR/66), it will be seen that para 3 at page 3 says “The rainfall data used in the study by CWC is the data collected by NWDA from IMD. There are discrepancies in this data and the data collected by Goa from IMD independently”. Further at the bottom of the same page, it says that a meeting was taken by the Hon’ble Minister of Water Resources, Government of India on 20 th December 2002, and in this meeting, it was decided that the Government of Goa

and CWC may make joint efforts to reconcile the discrepancies in the data and yield figures. On Page 4, the third paragraph says “…Therefore, after the Ministerial Level Meeting, it was decided by CWC to independently obtain authenticated rainfall data directly from IMD, Pune for carrying out the study”.

Thus, it would be appreciated that discrepancies in the rainfall data prior to 2003 was a known fact, which is why a decision was taken to do the study again after obtaining data directly from the IMD Pune.

1357

I do not know whether the CWC in 2003 obtained the data directly from IMD, and if so what was that data. However, sometimes in 2014, the Government of Goa obtained the data directly from IMD Pune. The data used by me is based on this data supplied by the IMD, Pune, in 2014.

b) If the data used is less than the correct datathen, yes it will have an impact on the yield. However, it has not been established that the lesser data is the correct data. On the contrary the discrepancies in the data prior to 2003 was a known fact, and the IMD data, as used by me is the data supplied directly by the IMD in 2014."

830.

The factual position, which emerges, from the above quoted answer is that, as regards, the variations, in the rainfall data, for certain years as used by Shri Pandit and also mentioned in the Report by the Panel of Experts, the source of data, obtained by the Panel of Experts, was not known to Shri Pandit.

831.

A major and serious flaw in the procedure adopted by Shri Chetan Pandit, Expert Witness for the State of Goa, for estimation of water availability, that has been noticed by the Tribunal, relates to applying a correction factor of ‘0.84’ (as mentioned at Para 17, page 57 of Volume 191) by Shri Chetan Pandit to the discharges observed by CWC at Ganjim site for the

period from 1979 to 2000, thereby reducing the quantum of observed runoff. This action on part of Shri Pandit was based on his assumption that the needed correction factor to convert ‘surface velocity’ to ‘mean velocity’ at the time of discharge observation by ‘Float Method’, was not applied by CWC while computing the daily discharges at site. However, his assumption was not based on the facts, since the ‘surface velocity’ was already converted into th e ‘mean velocity’ by applying a correction factor of ‘0.89’ by CWC, as is apparent from “Velocity Observation by Float dated 3.7.01 prepared by CWC at Site No. 25A, Ganjim” [MARK -15 (Colly)]. Hence the process of reducing the values of the annual runoff by Shri Pandit and using these reduced values of runoff for development of rainfall-runoff model is erroneous, faulty and unwarranted.

832.

Obviously, the assessment of water availability of Mahadayi river basin, made by Shri Chetan Pandit, Expert Witness of the State of Goa, which is based on a model developed by him, using the runoff data modified, on the basis of

erroneous assumption resulting into underestimation of runoff, cannot be considered, as reasonable and reliable. The assessment of water availability as projected by the State of Goa

1359

and the one reported by the Expert Witness of the State of Goa in his Report, are apparently on lower side, and therefore, it is difficult by the Tribunal, to accept the same.

Examination of Report of Shri S. N. Huddar of September 2015 [Volume 163(a)]

833.

The Report of Shri S. N. Huddar, Expert Witness of the State of Maharashtra, has for all practical purposes, endorsed the findings of the Report of CWC of 2003 (Volume 15) in respect of water availability for the entire Mahadayi basin with catchment area of 2032 sq.km.

834.

At Para 4.2 on page 19 of his Affidavit dated 13.9.2015 [Volume 163(a)], Shri Huddar stated that he got the rainfall-runoff relationship derived by CWC checked from his team. In this regard, the learned Advocate General of the State of Goa asked Shri Huddar as to what all was checked by him and his team. The question No. 3 put to Shri Huddar and his reply are reproduced hereunder.

1360

“Q.No.3. Please refer to Paragraph 4.2 on page 19 of your Affidavit dated 13 th September 2015, (Vol 163a), wherein you have stated as under:-

“I have got the rainfall -runoff relationship derived by CWC, checked from my team. …”

Could you please state what all was checked by you and your team? More specifically, did you check the following:-

a) The selection of the rainfall stations used for computing weighted rainfall at Ganjim;

b) The selection of the rainfall stations used for computing weighted rainfall for entire catchment;

c) The drawing of Thiessen polygon at Ganjim;

d) The measurement of areas of Thiessen polygon at Ganjim;

e) The computation of Thiessen weights at Ganjim;

f) The drawing of Thiessen polygon for entire catchment;

g) The measurement of areas of Thiessen polygon for

entire catchment;

h) The computation of Thiessen weights for entire catchment;

i) The adding of the daily rainfall data, from IMD's files, in order to obtain the monthly rainfall data;

j) The adding of the daily runoff dat a, from CWC's files, in order to obtain monthly runoff data;

k) The filling of the missing rainfall data;

l) The consistency checks applied to the rainfall data;

m)Any other checks applied to the rainfall data

n) The computation of the non-monsoon contribution;

o) The derivation of the regression equation;

p) The application of the regression equation to data prior to 1979, and, the preparation of estimated runoff series;

q) The determination of 75% dependable yield from the runoff series.

Could you please list, out of these, what all was checked by you and by your team?

Ans. I only checked, through the assistance of my team, the derivation of the regression equation and compared it with the equation arrived at by CWC (2003) Report, ignoring the data points for 1980 to 1984, 1988, 1990, 1995 and 1996. Before doing so, I had also checked the R-R equation without deleting the data points from 1979 to 1997 and compared both the equations so derived. In my Study annexed as Annexure 1 (Exh.MAH-MW/1/1) and I have described my findings in para 9.0 to para 12.0 (pages 32-34).

The paras (a) to (n) and (p), in the question were not

checked by me and my team. Based on the monsoon rainfall figures from the CWC (2003) Report, for the years 1928 to 2000, from Annexure VIII, from CWC (2003) Report and for years 2001 to 2005 were taken from Annexure 3, the IISc Bangalore Study Document at Volume No. 86(a) and with R-R relation equation worked out the monsoon yield to which I added non-monsoon runoff at the percentage given in CWC (2003) Report and worked out the annual yield and compared with the CWC figures.

1362

My results for para (q) are mentioned at the end of proforma (c) to my Study at page 41."

835.

From his reply, it is apparent that Shri Huddar has not examined the CWC (2003) Report properly. This is also evident from the reply of Shri Huddar to question No. 4 wherein he categorically stated as under.

" I have not scrutinized CWC (2003) Report at Volume 15 in details. The only thing I looked in this Report is the estimated yield of 5652 Mcum at 75% dependability and considered it as a reasonable estimate."

From above, it is apparent that Shri Huddar has not examined the Report of CWC with due care and therefore his conclusion at Para 20 on page 36 of his Report cannot be considered as reliable.

836.

Shri S. N. Huddar at Para 6.2, page 25 of his Affidavit [Volume 163(a)] has stated that "contribution to the Mandovi basin from Maharashtra's portion is of the order of 184 Mcum and 262 Mcum at 75% and average dependability respectively

which may be considered for allocation purpose”.

1363

837.

The procedure adopted by Shri Huddar for estimation of water availability of Mandovi (Mahadayi) basin, from Maharashtra's portion of the Mahadayi catchment appears to be broadly in order.

838.

However, the Tribunal finds that, Shri Huddar has not taken up any independent study, for assessment of water availability of the entire Mahadayi basin. In reply to question No. 12, put to him by the Tribunal on 14.11.2017, Shri Huddar has stated as under.

" Q.No.12. (At the commencement of this question, we have shown three documents to the witness, as follows:

i. Relevant pages from the book titled "Introduction to Linear Regression Analysis (Third Edition) by Douglas C. Montgomery, Elizabeth A. Peck and G. Geoffrey Vining". The same is taken on record and is marked as MARK-31.

ii. Relevant pages from the publication titled

“Chapter A3 Statistical Methods in Water Resources by D.R.Helsel and R.M.Hirsch of Book4, Hydrologic Analysis and Interpretation” of the United States Geological Surveys (USGS). The same is taken on record and is marked as MARK-32.

iii. Relevant pages from the publication titled “Training module #SWDP -37 – How to do hydrological data vali dation using regression” prepared under Hydrology Project by DHV

Consultant BV & Delft Hydraulics. The same is taken on record and is marked as MARK-33.)

We find that you have adopted a simple linear equation to represent the Rainfall-Runoff relation in respect of Mahadayi basin, and you have estimated the parameters of the simple linear equation i.e., ‘slope’ and ‘intercept’ by using a computer programme on linear regression. It is, however, not clear from your Report [Vol.163 (a)], whether you have examined the various assumptions related to linear regression and satisfied yourself about validity of these assumptions before proceeding ahead with development of simple linear equation for Mahadayi basin at Ganjim site. We also note that you have used the criteria of R 2 only for testing the model adequacy.

Relevant extract from the book titled “Introduction to Linear Regression Analysis (Third Edition) by Douglas C. Montgomery, Elizabeth A. Peck and G. Geoffrey Vining” (MARK-31) are reproduced hereunder:-

“The major assumptions that we have made thus far in our study of regression analysis are as follows:

1. The relationship between the response *y* andthe regressors is linear, at least approximately.

2. The error term 🎁 haszero mean.

3. The error term 🎁 hasconstant variance σ 2 .

4. The errors are uncorrelated.

5. The errors are normally distributed.

Taken together, assumptions 4 and 5 imply that the errors are independent random variables. Assumption 5 is required for hypothesis testing and interval estimation.

We should always consider the validity of these assumptions to be doubtful and conduct analyses to examine the adequacy of the model we have tentatively entertained. The types of model inadequacies discussed here have potentially serious consequences. Gross violations of the assumptions may yield an unstable model in the sense that a different sample could lead to a totally different model with opposite conclusions. We usually cannot detect departures from the underlying assumptions by examination of the standard summary statistics, such as the *t* or *F* statistics,or *R2* .These are "global" model properties, and as such they do not ensure model adequacy."

Yet another important aspect relates to 'Validation of Regression Model'. In this regard, relevant e xtract from

the above mentioned book are reproduced hereunder:-

“Regression models are used extensively for prediction or estimation, data description, parameter estimation, and control. Frequently the user of the regression model is a different individual from the model developer. Before the model is released to the user, some assessment of its validity should be made. We distinguish between model adequacy checking and model validation. Model adequacy checking includes residual analysis, testing for lack of fit, searching for high-leverage or overly influential observations, and

other internal analysis that investigate the fit of the regression model to the available data. Model validation, however, is directed towards determining if the model will function successfully in its intended operating environment.

Since the fit of the model to the available data forms the basis for many of the techniques used in the model development process (such as variable selection), it is tempting to conclude that a model that fits the data well will also be successful in the final application. This is not necessarily so. For example, a model may have been developed primarily for predicting new observations. There is no assurance that the equation that provides the best fit to existing data will be a successful predictor. Influential factors that were unknown during the model-building stage may significantly affect the new observations, rendering the predictions almost useless. Furthermore, the correlative structure between the repressors may differ in the model-building and

prediction data. This may result in poor predictive performance for the model. Proper validation of a model developed to predict new observations should involve testing the model in that environment before it is released to the user.”

These aspects are also highlighted in the “Chapter A3 – Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsch of Book 4, Hydrologic Analysis and Interpretation” of the United States Geological Surv eys (USGS) (MARK-32) Detailed procedures are also described in the publication titled “Training module # SWDP-37 – How to do hydrological data validation using

regression" prepared under Hydrology Project by DHV Consultant BV & Delft Hydraulics. In particular, relevant extract from Para 9.3, page 228 of "Chapter A3 – Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsch of Book 4, Hydrologic Analysis and Interpretation" of the USGS (MARK -32) is reproduced hereunder: -

" **9.3Building a Good Regression Model**

A common first step in performing regression is to plug the data into a statistics software package and evaluate the results using R 2 . Values of R 2 close to 1 are often incorrectly deemed an indicator of a good model. This is a dangerous, blind reliance on the computer software. An R 2 near 1 can result from a poor regression model; lower R 2 models may often be preferable. Instead of the above, performing the following steps in order will generally lead to a good regression model. …"

Various steps i.e. steps 1, 2, 2a, 2b, 2c, 3, 3a, 3b, 3c, 3d, and 4 are described at pages 228 to 237 of the "Chapter

A3 – Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsch of Book 4, Hydrologic Analysis and Interpretation" of the USGS.

In this regard, please answer the following:

a. Whether you undertook studies to satisfy yourself that a simple linear equation would be most appropriate rainfall-runoff model, particularly in view of various assumptions related to linear regression analysis, and validity of the same in case

of data related to rainfall and runoff up to Ganjim site of Mahadayi basin? If yes, please indicate the relevant pages of your Report where these aspects have been discussed. If no, why such important aspects were not considered by you?

b. Why did you rely upon R 2 value alone and did not carry out necessary investigations essentially required for finding the best fit equation?

c. Whether you undertook studies related to validation of the Regression Model? If yes, please indicate the relevant pages of your Report where these aspects have been discussed. If no, why such important analysis was not considered necessary?

Ans. The point-wise answers are as under:

a. While preparing my affidavit, my approach, as far as reliance by the State of Maharashtra on CWC (2003) Report is acceptable or otherwise and hence I have not gone into the detailed study to satisfy whether a simple linear equation is

appropriate or otherwise. I had just used the data from CWC and checked the regression equation they have developed is in order or not. After deleting the inconsistent runoff factor figures, I verified the equation and since they were nearly the same, I concluded that Maharashtra's reliance is acceptable.

1369

b. As stated to answer to (a) above, I have not investigated further details, but just to check the regression analysis.

c. No, I did not undertake studies related to validation of the regression model."

839.

In view of above position, the recommendations of Shri S. N. Huddar for adopting the yield estimated by CWC in its Report of 2003 is found to be completely erroneous and cannot be accepted by the Tribunal.

840.

From aforesaid Paras, it is apparent that neither the assessment of water availability by the State of Goa, which apparently is on lower side nor the assessment of water availability by the State of Karnataka which is on higher side nor the recommendations of the State of Maharashtra in respect of yield of Mahadayi river basin, can be considered to be valid and are not accepted by the Tribunal.

841.

Therefore, it becomes necessary for the Tribunal to undertake independent study to arrive at a rational estimate of the water availability of the Mahadayi river basin.

1370

842.

As a first step, the Tribunal considers it necessary to undertake independent analysis of the data made available by the respective State Governments to satisfy about the consistency of the data or otherwise and decide whether such data could be used for independent analysis.

Examination of Report of Shri Subrai T. Nadkarni of November 2017 (Volume 208)

843.

Shri Subrai T. Nadkarni, witness on behalf of the State of Goa, in his Report of November 2017 (Volume 208), has also included the results of his study on sub-basin wise water availability for various sub-basins, namely, Ragada, Khandepar, Kotrachi, Valvanti, Bicholim, Assnora, Surla, Siquerim, Kudnem and Madei stem. Shri Subrai T. Nadkarni has stated that the availability of water sub-basin wise has been extended based on the hydrology study done by Shri Chetan Pandit. He has further, stated that the present exercise is just a computation of the water availability sub-basin wise based on extension of hydrology

study by Shri Chetan Pandit. The result of the study of Shri Subrai T. Nadkarni are summarized in Table 13 at page 65 of his Report of November 2017 (Volume 208).

1371

844.

Table on page 42 of the Report of November 2017 of Shri Nadkarni (Volume 208) indicates mean annual flows for various sub-basins. In Table 13 on page 65, the 75% dependable yield of various sub-basins are shown. The Tribunal notes that the values of mean annual flow and the values of 75% dependable yield are same of all the sub-basins. The values of mean annual flow and the values of 75% dependable yield cannot be the same. Obviously, there are some errors.

845.

It is noted that in Table 13, Shri Nadkarni has also indicated the total water availability as 3283.3 Mcum (115.9 tmc). The Tribunal notes that the corresponding value of water availability indicated in the Report of Shri Chetan Pandit (Volume 191) is 3277.2 Mcum (115.7 tmc), which was subsequently modified by Shri Pandit as 3214.70 Mcum (113.5 tmc) during the course of reply to question No. 154. It is noted that Shri Nadkarni has not indicated as to why he considered it necessary to compute the water availability at 75% dependability for the total

catchment by summing up the water availability at 75% dependability of various sub-basins. Shri Nadkarni has also not explained the reason for variation from the value arrived at by Shri Pandit. However, in reply to question No. 3, Shri Nadkarni

stated that he had carried out the arithmetic by adding up the 75% dependable figure to find overall excess / deficiency and that he agreed that the overall 75% dependability would be as evaluated by Shri Chetan Pandit, and he stood by the result of 113.5 tmc for the whole basin assessed by Shri Pandit. The question No. 3 and the reply of Shri Nadkarni are reproduced hereunder.

“Q.No.3. In the Table at Para 30, pages 14 -15 and in the Table 13, page 65 of your Affidavit dated 14.11.2017 (Vol. 208), you have indicated the sub-basin wise availability of water (in Mcum) at 75% dependability in the second column.

It is noted that the total availability of water at 75% dependability has been shown as 3283.30 Mcum, which is equal to 115.9 tmc after conversion from Mcum to tmc.

Why have you undertaken sub-basin wise assessment of water availability at 75% dependability and to sum up to arrive at a new yield figure for the Mahadayi basin?

Ans. I had carried out the arithmetic by adding up the 75% dependable figure to find overall excess/deficiency. However, I agree that for the whole basin, the overall 75% dependability will be the effect of 13 Stations, as evaluated by Shri Chetan Pandit, and I stand by his result of 113.5 TMC for the whole basin.

1373

I took up sub-basin study as I wanted to evaluate as to what would be the effect of availability and demands in each sub- basin."

846.

In view of above, result obtained by Shri Nadkarni in respect of water availability from the catchment area of 1523 sq.km. at 75% dependability becomes redundant for all purposes.

Critical Examination of Consistency of Observed Discharge Data

847.

The Tribunal notices that the Expert Witnesses of the State of Goa and the State of Karnataka have used the observed discharge data of CWC site at Ganjim. Although, Shri Chetan Pandit, the Expert Witness of the State of Goa has highlighted several deficiencies in the process of observation of data at Ganjim in paras 9(e), 9(f), 9(g),and 9(h) on pages 48-49 of his report (Volume 191), he has used the same data after applying a correction, based on his assumption that CWC did not apply the necessary correction for converting the 'surface velocity'

measured through ‘Float Observation Method’ into the ‘mean velocity’. The Tribunal notes that his assumption was not based

on facts. Further the method used for arrivi ng at the ‘correction factor’ is not in accordance with the procedure prescribed at Para 5.2 of Bureau of Standards (BIS) Code “IS 3911:1994, Surface Floats – Functional Requirements” [MARK – MAH2 (Colly)] and at Para 7.2.5.1 and Para 7.2.5.2 of BIS Code “ IS 1192:2013 – Hydrometry – Measurement of Liquid Flow in Open Channels using Current- meters or Floats” (MARK -14). The relevant paragraphs of “IS 3911:1994, Surface Floats – Functional Requirements” are reproduced hereunder.

“5.2 In the selected reach, measurements shall be made at as near a stage as possible by current meter, preferably by the integration method according to IS 1192:1981, and the coefficient for obtaining the mean velocity in the vertical worked out for the float. In the absence of a more reliable figure a reduction coefficient of 0.85 may be adopted.

NOTE – The reduction coefficient generally vary from 0.79 to 0.92. This reduction coefficient is not a constant even for a particular channel, since it varies with depth, slope, and relative roughness of

the channel boundary. It may also be obtained from Von Karman's logarithmic velocity distribution law. "

The relevant paragraphs of "IS 1192:2013 – Hydrometry – Measurement of Liquid Flow in Open Channels using Current-meters or Floats" are also reproduced hereunder.

1375

“7.2.5.1 Method

The float velocity shall be determined by dividing the distance between the cross-sections by the time taken by the float to travel this distance. Several measurements of the float velocities shall be taken and the mean of these measurements shall be multiplied by the appropriate coefficient to obtain the mean velocity in the segment. The coefficient derived from current-meter measurements at the site at a stage as near as possible to that during the float measurement may be used for converting the float velocity to mean velocity.

7.2.5.2 Surface float

Where it is not possible to check the coefficient directly, it may be assumed for guidance that, in general, the coefficient of the surface float varies between 0.84 and 0.90 depending upon the shape of the velocity profile. The higher values are usually obtained when the bed is smooth, but values outside this range may occur under certain circumstances.”

848.

On the other hand, Prof. A. K. Gosain, the Expert Witness of the State of Karnataka has considered, the observed discharge data of CWC site at Ganjim as correct, but still he chose to ignore data of 9 years out of 34 years without undertaking detailed investigations as to why these data should be considered as inappropriate and should be brushed aside, for the purpose of

further analysis. Surprisingly, none of the Experts i.e., Shri Chetan Pandit or Prof. A. K. Gosain had made any effort to examine and use the discharge data observed by the three States namely, the State of Goa, the State of Karnataka and the State of Maharashtra.

849.

With a view to independently examining whether the observed discharge data of CWC site at Ganjim can be considered as wholly reliable, the Tribunal has made an effort to compare the observed discharge data of CWC site at Ganjim with the data observed and filed by the respective States.

850.

The various States have filed the observed discharge data, of the following sites.

a. Data observed by the State of Karnataka at Chapoli site for the years 1980 and 1983 to 1991 and that from 2000-01 to 2011-12

b. Data observed by the State of Maharashtra at Virdi site for the period from 1986-87 to 2004-05 and from 2006-07 to

2011-12

1377

c. Data observed by the State of Goa at Daucond site for the period from 2010 to 2013

d. Data observed by the State of Goa at Khadki site for the period from 2010 to 2012

e. Data observed by the State of Goa at Kudchire site for the period from 2009 to 2013

f. Data observed by the State of Goa at Paikul site for the period from 2009 to 2013

851.

However, the data observed by the State of Goa for the Gauging Stations, namely, Daucond, Khadki, Kudchire and Paikul are relatively of shorter duration of 3 to 5 years only.

852.

It is further noted by the Tribunal that there are inconsistencies in the data reported by the State of Goa. Shri Chetan Pandit, Expert Witness of the State of Goa was asked about the inconsistencies in the data of the Stations maintained by the State of Goa. In reply to question No. 163 put to him, by the Tribunal, on 6.10.2016, Shri Chetan Pandit stated that the

data was not reliable and that the observation procedure was yet to stabilize. Question No. 163 and the reply thereof are reproduced hereunder.

1378

“Q -163: Information culled out from the data submitted by Central Water Commission (vide report titled “Consistency Analysis of Flow Data in Mahadayi Basin” filed on 1.12.2014) and that by the State of Goa (vide Exhibit ‘B’ of the report titled “Submission of the State of Goa in Compliance with Paragraph 4 of the Order dated 3.9.2014 passed by this Honourable Tribunal” filed on 22.12.2014) are presented hereunder.

Year	Annual runoff at Ganjim site of CWC (in mm)	Annual runoff at sites maintained by the State of Goa (in mm)	
		Khadki	Kudchire
2010-11	4327	4459	-
2011-12	5961	8361	-
2012-13	3941	6497	1952
2013-14	-	8348	2966

We note that there are wide variations in annual runoff

(in terms of depth in mm) at different sites. In particular, the variations in the annual runoff (in mm) in respect of Khadki and Kudchire sites maintained by the State of Goa during the years 2012-13 and 2013-14 are on very high side. Obviously, such variations are not acceptable. What are your comments?

Ans. I have not analysed the data at any station beyond 2005 and also I have not analysed the data at Khadki and Kudchire for any duration and therefore, I am not able to explain the variation at this point of time. I have been

given the data along with the question. I will analyse the same during the evening and report the outcome tomorrow."

853.

On 7.10.2016, Shri Pandit stated further as under.

"I was asked to comment on the annual runoff for the years 2010-11 to 2013-14 as Khadki and Kudchire discharge observation sites maintained by the State of Goa. I have examined the same. The Khadki site is located on the main river Mahadayi approximately 7 KMs, upstream of the Ganjim site. There are no major diversion works between Khadki site and Ganjim site. Therefore, there is no logical reason for the flow at Khadki to be more than the flow at Ganjim. The flow at Khadki for the years referred above is not only more than the flow at Ganjim, but in 2011-12 and 2012-13, it is significantly more. Therefore, in my opinion, this data is not reliable.

The Kudchire site is located on river Bicholim which is a

tributary of Mahadayi and meets the main river Mahadayi downstream of Ganjim site. Therefore, the flow observed at Kudchire cannot be compared to flow observed at Ganjim site. One way to form an opinion about the flow observed at Kudchire site is by comparing it with the rainfall in its catchment for the years concerned. This data is not readily available and, therefore, at this moment no opinion can be expressed about the reliability of data at this site.

I was informed by the WRD Goa Engineers that both these sites have been newly established under the

1380

Hydrology Project and, perhaps in 2010 to 2014, the observation procedure was yet to stabilize. ”

(Emphasis supplied)

854.

In view of above position, the data for the aforesaid gauging Stations filed by the State of Goa, have not been considered by the Tribunal for the purpose of comparison with the observed discharge data of CWC site at Ganjim.

855.

The Tribunal also notices that the data of Chapoli site submitted by the State of Karnataka for the years 1980 and from 1983 to 1991, have been furnished by the State of Karnataka as “Annexure – B (Colly) – Observed Hydrological Data of Gauging at Kotni Dam Site” [Vol ume 98(a)]. Data are in the form of data sheets observed by site officials, with missing records of observations on considerable number of dates. The observed discharge data during the monsoon period of five months (i.e., 153 days of June to October) are found to be only for 5 days in 1980, 44 days in 1983, 85 days in 1984, 102 days in 1985, 93 days

in 1986, 79 days in 1987, 74 days in 1988, 90 days in 1989, 91 days in 1990 and 118 days in 1991. Therefore, it is not considered appropriate, by the Tribunal to use such data even for the limited purpose of comparison by the Tribunal.

1381

856.

The annual runoff data of the following three sites

are, however, examined and presented in Table-1.

Table-1: Comparison of Reported Observed Rainfall Data – Data of Ganjim, Khadki, Kudichire, Chapoli

and Virdi in millimeters (mm) and Data of Daucond and Paikul in million cubic meters (Mcum)

Year	Runoff at CWC Site at Ganjim (CA = 880 sq.km.)	Khadki Site of State of Goa	Daucond Site of State of Goa	Kudchire Site of State of Goa	Paikul Site of State of Goa	Chapoli Site of State of Karnat-aka (CA = 124.4 sq.km.)	Virdi Site of State o Mahar shtra (CA = 35.43 sq.km.
1	2	3	4	5	6	7	8
1979-80	3292						
1980-81	5022						
1981-82	4432						

1982-83	4789						
1983-84	4309						
1984-85	4020						
1985-86	3505						
1986-87	2901						1472
1987-88	2543						1946
1988-89	4680						3449
1989-90	3143						2896
1990-91	4567						2933
1991-92	3749						2714

1992-93	3768						7059
1993-94	3750						2233
1994-95	5362						5566
1995-96	3342						2874
1996-97	2900						2972
1997-98	4227						3688
1998-99	3288						3413
1999-00	4457						2895
2000-01	3627					2535	2331
2001-02	2767					2149	3064

2002-03	2674					2269	1899
2003-04	2935					2240	2416
2004-05	3028					2901	2370
2005-06	4328					4640	
2006-07	4946					4746	4931
2007-08	5649					4451	5174
2008-09	4478					3474	4717
2009-10	3433				321	3251	1647
2010-11	4327	4459	1063		440	2639	3197
2011-12	5961	8361	1043		772	3686	3435

2012-13	3941	6497	1090	1952		2206	

2013-14		8348	1544	2966		3184		
Total	134141	27665		4918		63704	81291	
Average	3949	6916		2459		3034	3252	

The result of the analysis carried out by the Tribunal are summarized as under.

a.

b.

c.

Average annual runoff at Ganjim (on : the basis of 34 years of data i.e., from 1979-80 to 2013-14)

Average annual runoff at Chapoli (on : the basis of 14 years of data i.e., from 2000-01 to 2013-14)

Average annual runoff at Virdi (on : the basis of 25 years of data i.e., from 1986-87 to 2004-05 and from

2006-07 to 2011-12)

3949 mm

3034 mm

3252 mm

857.

The Tribunal finds that obviously, the runoff observed at Ganjim Site is, on relatively very high side. However, since the periods of observed data at the three Sites are different, the comparison must be termed as inappropriate. Therefore, the data of concurrent periods for the three Sites, as referred to above, were also compiled by the Tribunal. The annual runoff data of the three sites for the concurrent period are presented in Table-2.

1383

Table-2: Comparison of Reported Observed Runoff

Data at Different Sites (in mm) of Concurrent

Period

Year	Runoff at CWC Site at Ganjim (CA = 880 sq.km.)	Chapoli Site of State of Karnataka (CA = 124.4 sq.km.)	Virdi Site of State of Maharashtra (CA = 35.43 sq.km.)
1	2	3	4
2000-01	3627	2535	2331
2001-02	2767	2149	3064
2002-03	2674	2269	1899
2003-04	2935	2240	2416
2004-05	3028	2901	2370
2006-07	4946	4746	4931
2007-08	5649	4451	5174

2008-09	4478	3474	4717
2009-10	3433	3251	1647
2010-11	4327	2639	3197
2011-12	5961	3686	3435
Total	43827	34341	35182
Average	3984	3122	3198

The results are summarized as under.

1384

a.

b.

c.

Average annual runoff at Ganjim (on :

the basis of 11 years of data i.e., from

2000-01 to 2004-05 and 2006-07 to

2011-12)

Average annual runoff at Chapoli (on :

the basis of 11 years of data i.e., from

2000-01 to 2004-05 and 2006-07 to

2011-12)

Average annual runoff at Virdi (on the :

basis of 11 years of data i.e., from

2000-01 to 2004-05 and 2006-07 to

2011-12)

3984 mm

3122 mm

3198 mm

858.

From the above, it is apparent that the average annual runoff at Ganjim Site, arrived at, on the basis of observed discharge data at the Hydrological Observation Station of CWC at Ganjim, is on higher side. This position is in contradiction with, the rainfall pattern, which is reported by the State of Goa as well that by the State of Karnataka as elaborated in the following Paras.

859.

At Para 1.2, pages 1-2 of the Report titled filed as "Exhibit A to the Submissions of the State of Goa in compliance with Paragraph – 4 of the Order dated 03/09/2014 passed by this Tribunal (Water Yield Studies for Mandovi River Basin – a linear

1385

regression ap proach)" [Exhibit GOA -148] [Volume 101(a)] the following has been stated.

"… Goa has a tropical monsoon climate and the region is generally warm and humid. The temperature ranges from 20°C to 34°C. The humidity is high throughout the year. The state receives an average annual rainfall of about 3200 mm. The rainfall occurs mostly due to orographic frontal process, as a result of the orographic influence the rainfall increases progressively from the coast to the Western Ghats. …"

860.

Prof. A. K. Gosain, Expert Witness of the State of Karnataka in his Report titled "The Yield Study of Mahadayi Basin" filed as Annex ure – B to his Affidavit dated 12.9.2015 [Exhibit KAR-RW1/2] (Volume 166) has stated as under in Para 2, at page 18.

"The basin receives major portion of its rainfall during the south west monsoon season. Over 90 percent of rainfall is received during four months of monsoon from

June to September. However, there is a significant variability in the rainfall across the basin. The normal rainfall in the basin varies from 2950 mm near seashore to about 5400 mm in the upper reaches of the basin.”

1386

861.

The Tribunal is of the considered view that from the aforesaid quoted paras, the discharge data observed at Hydrological Observation Station of CWC at Ganjim, cannot be relied upon.

862.

It is noted by the Tribunal that neither the State of Goa nor the State of Maharashtra has raised any issue relating to inconsistency or non-reliability of the discharge data observed at Chapoli gauging site of the State of Karnataka. However, it is also observed that even the State of Karnataka has not used the discharge data observed at Chapoli. Further, the catchment area up to Chapoli site is only about 124.4 sq.km., which is relatively much lesser as compared to the total area of Mahadayi basin of 2032 sq.km., and therefore, the use of data at this site for development of Rainfall-Runoff model, to be used for assessment of water availability for the entire basin, is not considered appropriate and is accordingly not considered.

863.

It is also noted by the Tribunal that the State of Goa and the State of Karnataka have not raised any issue about inconsistency or non-reliability of the discharge data observed at Virdi gauging site of the State of Maharashtra. However, the

catchment area up to this site, is still lower. The catchment area up to Virdi gauging site is only 35.43 sq.km. against the total catchment area of 2032 sq.km. of the entire Mahadayi basin river basin, and it is not safe to rely upon such discharge data, for the assessment of availability of water.

864.

In view of above position, neither the observed discharge data at the Hydrological Observation Station of CWC at Ganjim nor the discharge data observed by the State of Goa at the four gauging Stations, namely Daucond, Khadki, Kudchire and Paikul nor the data observed by the State of Karnataka at Chapoli gauging Site nor the data observed by the State of Maharashtra at Virdi gauging Station, are found appropriate, by the Tribunal, for assessment of the water availability for the entire Mahadayi river basin or for development of a Rainfall-Runoff model to be used, for water availability assessment, for the entire Mahadayi river basin.

Critical Examination of Consistency of Rainfall Data

865.

The issues relating to consistency of rainfall data have been discussed at length during the course of examination of the

issues raised for determination as well as during the examination of the Reports which have been filed by the State of Goa or by the State of Karnataka.

866.

From perusal of the information provided in various documents filed by the party States, the Examinations-in-Chief and cross examinations of the Expert Witnesses of party States, on the subject of hydrology and water availability, some inconsistencies in the rainfall data and its processing, have been noticed by the Tribunal which are summarized as under.

a. Choices of different sets of rain gauge stations for assessment of average rainfall :10 rain gauge stations, namely,

Amagaon, Jamagaon, Kankumbi, Ponda, Valpoi, Sanguem, Gawali, Chapoli, Krishnapura, and Kotni dam have been selected by Shri Chetan Pandit, Expert Witness of Goa, for assessing the average rainfall over the catchment up to Ganjim site. On the other hand, Prof. A. K. Gosain, Expert Witness of Karnataka has selected only 7 rain gauge

stations, namely, Amagaon, Jamagaon, Kankumbi, Ponda, Valpoi, Khanapur, and Castlerock for assessing the average rainfall over the catchment up to Ganjim site. Thus only five

1389

rain

gauge

stations,

namely,

Amagaon,

Jamagaon,

Kankumbi, Ponda and Valpoi are found to be common in the two lists. For assessing the average rainfall of the entire Mahadayi basin, Prof. A. K. Gosain considered 12 influencing rain gauge stations (Ref: Para 7.3.2, page 41, Volume 166) for varying period from 1928-29 to 2012-13, whereas Shri Chetan Pandit has considered data from 13 rain gauge stations. Similarly, there are variations in the choice of rain gauge stations for assessing the average rainfall over the catchment area of different proposed project sites. This is apparent from the following Table.

Proposed project sites	**Rain gauge stations selected by Prof. Gosain (Vol. 193)**	**Rain gauge stations selected by Shri Pandit (Vol. 195)**

Bhandura dam	Chapoli, Gavali and Jamagaon	Jamagaon
Kotni dam site (independent catchment)	Jamagaon	Jamagaon, Chapoli, Gavali and Kotni
Irti pick-up dam (independent catchment)	Chapoli and Gavali	Chapoli, Gavali and Kotni
Katla-Palna diversion	Castle Rock	Sanguem
Diggi diversion	Castle Rock	Sanguem

Viranjole diversion	Castle Rock	Jamagaon, Valpoi and Krishnapura

b. Selection and use of varying length of rainfall data :Though the Tribunal has rejected CWC (2003) Report, as unreliable, it is noticed, just for the sake of mention that, the Report of CWC of 2003 (Volume 15), rainfall data of 70 years i.e., from 1928-29 to 1997-98, have been used. In the Report of Prof. A. K. Gosain of August 2015 (Volume 166), he has used the rainfall data of 85 years i.e., from 1928-29 to 2012-13, whereas Shri Chetan Pandit, in his Report of August 2016 (Volume 191) has used the rainfall data of only 42 years i.e., from the 1964 to 2005.

c. Variations in the values of rainfall at same rain gauge station as reported in two different documents filed by the same State :There are variations in the rainfall data of some years in respect of Rain Gauge stations at Valpoi, Sanguem, Kankumbi, Amagaon and Chapoli in two Reports filed by the State of Goa, i.e., the Report of the Panel of Experts (Annexure-120 in Volume 31) and the Report of Shri Chetan

Pandit, Expert Witness of the State of Goa (Volume 196).

The variations in the values of the rainfall data in two

Reports are indicated in the following Tables.

1391

Comparison of Monsoon Rainfall of Valpoi and Sanguem Raingauge Stations in

Different Documents furnished by the State of Goa

Year	Valpoi			Sanguem		
	As per Table-2, Page 15, Vol.-196	As per Proforma 5.10, pages 75-78 of Report of Panel of Expert, Vol.II	Variation between Col. 2 and Col. 3 (in %)	As per Table-2, Page 15, Vol.-196	As per Proforma 5.5, pages 57-60 of Report of Panel of Expert, Vol.II	Variation between Col. 5 and Col. 6 (in %)
1	2	3	4	5	6	7
1964	4189.9	4202.0	-0.29	2552.9	2602.0	-1.92
1965	3598.1	3598.0	0.00	3440.1	3441.0	-0.03
1966	3726.0	3729.0	-0.08	2872.5	2973.0	-3.50
1967	4083.2	4015.0	1.67	2862.0	3461.0	-20.93
1968	4017.0	4017.0	0.00	3323.7	3321.0	0.08

1969	3984.3	3975.0	0.23	3737.3	3737.0	0.01
1970	4704.4	4707.0	-0.06	4168.0	4558.0	-9.36
1971	2321.4	3754.0	-61.71	2010.0	3348.0	-66.57
1972	1961.3	3191.0	-62.70	1698.2	2767.0	-62.94
1973	3820.5	3820.0	0.01	2857.4	2857.0	0.01
1974	4880.3	4363.0	10.60	3160.0	3736.0	-18.23
1975	4856.5	4857.0	-0.01	3762.0	3761.0	0.03
1976	3511.6	3582.0	-2.00	3040.7	4170.0	-37.14
1977	3962.8	4052.0	-2.25	3431.3	3785.0	-10.31
1978	4622.3	5088.0	-10.08	4002.3	4300.0	-7.44
1979	3644.6	3640.0	0.13	3418.5	3201.0	6.36
1980	5061.3	4308.0	14.88	4382.5	3678.0	16.08
1981	4384.0	4385.0	-0.02	4460.4	4460.0	0.01
1982	4661.3	4713.0	-1.11	4182.7	4183.0	-0.01

1983	4787.1	4190.0	12.47	3897.4	3900.0	-0.07
1984	3956.7	3807.0	3.78	3085.0	2785.0	9.72
1985	3648.3	3692.0	-1.20	4052.0	4051.0	0.02

Comparison of Monsoon Rainfall of Kankumbi and Amagaon Raingauge Stations

in Different Documents furnished by the State of Goa

Year	Kankumbi			Amagaon		
	As per	As per	Variation	As per	As per	Variation

	Table-2, Page 15, Vol.-196	Proforma 5.14, page 91 of Report of Panel of Expert, Vol.II	between Col. 2 and Col. 3 (in %)	Table-2, Page 15, Vol.-196	Proforma 5.16, page 95 of Report of Panel of Expert, Vol.II	between Col. 5 and Col. 6 (in %)
1	2	3	4	5	6	7
1964	1964.0	4932.0	-151.12	2599.4	2599.0	0.02
1965	1943.1	5172.0	-166.17	2231.6	2231.0	0.03
1966	1394.5	1506.0	-8.00	1799.2	1800.0	-0.04
1967	3952.1	2264.0	42.71	3423.8	3095.0	9.60
1968	1953.7	1897.0	2.90	2057.4	2048.0	0.46
1969	1983.4	1967.0	0.83	2291.8	2294.0	-0.10
1970	2289.5	2287.0	0.11	2505.6	2504.0	0.06
1971	1815.9	1801.0	0.82	2222.4	2217.0	0.24

1972	1834.9	1692.0	7.79	1968.0	1968.0	0.00
1973	2044.2	2027.0	0.84	2203.3	2181.0	1.01
1974	2276.0	2251.0	1.10	2363.3	2364.0	-0.03
1975	4842.4	1854.0	61.71	2054.5	2055.0	-0.02
1976	4198.8	5602.0	-33.42	3637.6	3624.0	0.37
1977	5360.6	5432.0	-1.33	2385.9	3386.0	-41.92
1978	7172.3	7173.0	-0.01	2884.6	2881.0	0.12
1979	5495.2	5496.0	-0.01	2920.0	2922.0	-0.07
1980	7865.3	7797.0	0.87	3061.7	3323.0	-8.53
1981	7280.3	7280.0	0.00	2856.7	2837.0	0.69
1982	6881.8	6881.0	0.01	3275.7	3291.0	-0.47
1983	6538.6	6537.0	0.02	2986.7	2987.0	-0.01
1984	5874.6	5875.0	-0.01	4251.6	3375.0	20.62
1985	5147.3	5003.0	2.80	4509.9	2943.0	34.74

Comparison of Monsoon Rainfall of Chapoli Raingauge Station in Different

Documents furnished by the State of Goa

Year	Chapoli Raingauge Station			Remarks
	As per Table-2, Page 15, Vol.-196	As per Proforma 5.19, page 101 of Report of Panel of Expert,	Variation between Col. 14 and Col. 15 (in %)	

		Vol.II		
1	2	3	4	5
1965	4375.0	1309.0	70.08	
1966	1309.0	610.0	53.40	
1967	610.0	3619.0	-493.28	
1968	3619.0	1335.0	63.11	
1969	1335.0	1601.0	-19.93	
1970	1601.0	1646.0	-2.81	
1971	1646.0	1034.0	37.18	
1972	1034.0	1322.0	-27.85	
1973	1322.0	1594.0	-20.57	
1974	1594.0	1587.0	0.44	
				Apparently, there is

1975	1587.0	3123.0	-96.79	shift in the rainfall values by one year.
1976	3123.0	4336.0	-38.84	
1977	4336.0	1625.0	62.52	
1978	1625.0	4547.0	-179.82	
1979	4547.0	4197.0	7.70	
1980	4197.0	5509.0	-31.26	
1981	5509.0	5691.0	-3.30	
1982	5691.0	7592.0	-33.40	
1983	7592.0	3902.0	48.60	
1984	4002.0	7312.0	-82.71	
1985	7312.0	5328.0	27.13	

Similarly, there are variations in the rainfall data reported in two different reports, namely Report of 2015 (Volume 166) and Report of 2017 (Volume 198) of Prof. A. K. Gosain, Expert Witness of the State of Karnataka as highlighted at

Para 54(a) and Para 54(b).

d. Use of different methods of filling-in the missing data :Just for the sake of mention, it is stated that, Central Water Commission, in its Report of 2003, has used the ‘Method of Normals’, whereas Shri Chetan Pandit, Expert Witness of the Sate of Goa has used the ‘Normal Ratio Method’ and

Prof. A. K. Gosain, Expert Witness of the State of Karnataka has also used the ‘Normal Ratio Method’ for filling -in some of the missing data. However, it is noted that the procedure for filling the missing rainfall data has been described in the “Hydro - Meteorology Handbook: Precipitation and Climate” prepared under Indian Hydrology Project of Ministry of Water Resources, River Development and Ganga Rejuvenation (MARK-18), are as under.

“ **Normalratio** –applied if the average annual rainfall of the station under consideration differs from the average annual rainfall at the neighbouring stations by more than 10%. The erroneous or missing rainfall at the station under consideration is estimated as the weighted average of the data at the neighbouring

stations. The rainfall at each of the neighbouring station is weighted by the ratio of the average annual rainfall at the station under consideration and average annual rainfall of the neighbouring station. The rainfall for the missing or the erroneous value at the station under consideration is estimated as:

$$P_{test} = \frac{1}{M}\left(\frac{N_{test}}{N_{base1}}P_{base1} + \frac{N_{test}}{N_{base2}}P_{base2} + \frac{N_{test}}{N_{base3}}P_{base3} + \cdots + \frac{N_{test}}{N_{base.M}}P_{base.M}\right)$$

Where,

N_{test} = annual average rainfall at the station under consideration

N_{basei} = annual average rainfall at the adjoining stations (for i = 1 to M)

A minimum of three neighbouring stations should generally be used for obtaining good estimates using the norm al ratio method."

The document titled "Hydro -Meteorology Handbook: Precipitation and Climate" prepared under Indian Hydrology Project of Ministry of Water Resources, River Development and Ganga Rejuvenation was shown to Prof. A. K. Gosain and is marked as MARK-18.

In this regard, relevant extract from "Handbook of Applied Hydrology by Ven Te Chow" (which was also shown to Prof. A. K. Gosain and is marked as MARK-11) is also reproduced as under.

" **3.Interpolation of Rainfall Records.** Frequently, records of rainfall for a certain station are missing for a day or several days, especially for cooperative stations. In order not to lose valuable information, it is desirable to have techniques for estimating the amounts for such days in calculating monthly and annual totals. The U.S. Weather Bureau [22] uses two

procedures for these estimations, both based on simultaneous records for three stations as close to and as evenly spaced around the station with missing records as possible: (1) if the normal annual precipitation at each of these stations is within 10 per cent of that for the station with missing records, a simple arithmetic average of the precipitation at the three stations is used for the estimated amount. (2) If the normal annual precipitation at any of the three stations differs from that of the station with missing

records by more than 10 per cent, the *normal-ratio method* isused. This method consists of weighting, by the ratios of the *normal-annual-precipitation* values,

$$P_x = \frac{1}{3}\left(\frac{N_A}{N_B}P_A + \frac{N_A}{N_C}P_B + \frac{N_A}{N_C}P_C\right)$$

Where, *N* isthe normal annual precipitation. It is readily seen that the second method is adaptable to regions where there is large orographic variation in the precipitation. The two procedures have been adapted to machine methods and are used routinely by the Weather Bureau. ”

It is observed that both the references suggest the use of data of at least three neighbouring Rain Gauge Stations.

It is observed that the prescribed procedure has not been followed.

e. Use of different methods of computing average rainfall :

Thiessen Polygon method has been used for estimation of average rainfall over the entire catchment area of

Mahadayi basin as also for the catchment area up to Ganjim site. However, for estimation of average rainfall over the catchment area of the most of the identified project sites, Arithmetic Mean method, has been used by the Expert Witnesses of the States of Goa and Karnataka.

$$\frac{1}{Nx}$$

$$\frac{}{Nx}$$

$$\frac{}{Nx}$$

1397

f. Non-application of all required consistency checks :Checks for the presence of trend in the long term rainfall data series have also not been applied either by the Expert Witness of the State of Goa or by the Expert Witness of the State of Karnataka. Similarly, checks for external consistency have also not been applied by them.

867.

In view of above, and particularly in view of variations in the values of the rainfall of a Station, in numerous cases in different Reports, it is not considered appropriate, by the Tribunal to use the rainfall data reported by the States in the Reports filed by them.

Assessment of Water Availability of Mahadayi Basin by the

Tribunal using an Independent Approach

868.

In view of highly varying values of the assessment of water availability of the Mahadayi basin as reported by the party States and the deficiencies noticed in the process of assessment, none of the assessments being acceptable, it has become necessary for the Tribunal, to make assessment of water availability of Mahadayi basin, independently.

1398

869.

The Tribunal has adopted the following approach.

Rainfall Data to be Used

870.

Since the rainfall data reported and used in different Reports filed by the States of Goa and Karnataka and by their respective Expert Witnesses were not found acceptable, the Tribunal decided to use the “High Spatial Resolution (0.25°x0.25°) Long Period Daily Gridded Rainfall Data”, which is processed by India Meteorological Department (IMD).

871.

In this regard, it is noted that Prof. A. K. Gosain, has prepared a Report titled “Analysis to check the Consistency of Rainfall data in and around Mahadayi River Basin” which has been filed by the State of Karnataka along with “Fur ther Response of the State of Karnataka to the Brief Note Handed over to the Hon’ble Tribunal at the Hearing on 11.02.2015 Read with Orders dated 03.9.2014 and 12.02.2015” (Vol ume 122). In the above said Report, following has been stated.

1399

“Recently, a n ew product of India Meteorological Department, in the form of high resolution gridded daily rainfall data (0.25°x0.25° resolution), derived using quality controlled station data (http://www.imd.gov.in/doc/nccraindata.pdf)has come into being which is supposed to be a much better product due to reanalysis, has been used here for consistency analysis. …”

872.

It is further noted by the Tribunal that the annual / yearly rainfall data for eight Gridded Points namely (a) 73°45'E 15°30'N, (b) 73°45'E 15°45'N, (c) 74°E 15°15'N, (d) 74°E 15°30'N, (e) 74°E 15°45'N, (f) 74°15'E 15°15'N, (g) 74°15'E 15°30'N, and (h) 74°15'E 15°45'N for the period from 1979 to 2011, were included in the above said Report in Table 1 on page 15 of Volume 122.

873.

With a view to independently examining and checking the annual rainfall data at different Gridded Points, included in the above said Report (Volume 122), the Tribunal requested the

National Climate Centre, India Meteorological Department, Pune to supply the
‘High Resolution (0.25°x0.25°) Daily Gridded
Rainfall Data’ vide letter No. 4/27/2015/MWDT/109/377 dated
17.9.2015.

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874.

India Meteorological Department supplied a CD of "daily gridded 0. 25°x0.25° rainfall data (1901- 2013)" vide its letter No. NCC/Product/6/2014/4362 dated 22.9.2015 to the Tribunal.

875.

From the Report of the India meteorological Department, received along with the data, it is noted by the Tribunal that India Meteorological Department has computed values of the rainfall at the Grid Points, after taking into consideration, all the data in and around the Grid Points, with due consideration to all aspects. Relevant extract from the publication titled "Development and Anal ysis of a New High Spatial Resolution (0.25°x0.25°) Long Period (1901-2010) Daily Gridded Rainfall Data Set over India" of the National Climate Centre, India Meteorological Department are reproduced hereunder.

"In this study, as a part of IMD's efforts to make use of all the available quality rain gauge data over the country

to prepare a high resolution daily rainfall data set for various applications such as climate variability & climate change studies, validation of model rainfall at various scales, hydrological modelling, drought monitoring etc., development of a new daily gridded rainfall data set

over India at a spatial resolution 0.25° × 0.25° for 110 years (1901-2010) have been discussed. The data set was prepared using the daily rainfall data from all the rain gauge stations over the country available in the IMD archive. …"

876.

In view of above features, Prof. A. K. Gosain, Expert Witness of the State of Karnataka was asked a question by the Tribunal on 13.7.2017. The Question No. 17 and the answer thereof are reproduced hereunder.

"Q.No.17. In your report titled "Analysis to Check the Consistency of Rainfall Data in and around Mahadayi River Basin" [Annexure A of "Further Response of the State of Karnataka to the Brief Note handed over to the Hon'ble Tribunal at the Hearing on 11.2.2015 (read with Orders dated 3.9.2014 and 12.2.2015)" – Vol. 122"] filed by the State of Karnataka on 15.4.2015, following has been stated: -

"Recently, a new product o f India Meteorological

Department, in the form of high resolution gridded daily rainfall data (0.25°x0.25° resolution), derived using quality controlled station data (http://www.imd.gov.in/doc/nccraindata.pdf)has come into being which is supposed to be a much better product due to reanalysis, has been used here for consistency analysis. Location of these grid points in and around the Mahadayi basin has been shown in Figure 2.

Therefore, under present situation, it is decided to use a recent product of India Meteorological Department, in the form of high resolution gridded daily rainfall data (0.25°x0.25° resolution), derived using quality controlled station data ….."

However, in the report titled "The Yield Study of Mahadayi Basin" submitted as Annexure -B of your Affidavit, you have not used the data contained in the new product of India Meteorological Department, in the form of high resolution gridded daily rainfall data which in your opinion is much better product.

Please explain the reasons for not using a much better product. Please also tell us whether the high resolution gridded daily rainfall data included in the new product of India Meteorological Department (which in your opinion is much better product) should be invariably used for development of rainfall runoff models and if not, the reasons therefor."

"Ans. I personally feel that the gridded daily rain fall

data, as provided by the IMD, is more suitable for the end users, since it is a processed rain fall data, checked for most of the possible errors. However, in the present case, since it was a matter of difference of opinion between the parties, I did not want to bring in another parameter, as to the authenticity of the gridded data itself, since I know that it is an end product of interpolation, of the available actually observed rain fall, and transformed on to a uniform grid of 0.25° x 0.25° by IMD. Therefore, having started in that direction, and submitting one Report of consistency of the gridded

data, as given along with this question, I decided to use the actual rain gauge stations for my analysis."

877.

Thus Prof. Gosain has asserted and informed the Tribunal that the gridded daily rain fall data, as provided by the IMD, is more suitable for the end users, since it is a processed rain fall data, checked for most of the possible errors.

878.

From above, the Tribunal concludes that the daily gridded 0.25°x0.25° rainfall data of the India Meteorological Department can be safely considered alongwith other data relied upon by the party States for the assessment of the availability of water of Mahadayi basin. Further, use of this data would certainly lead to convergence, at least, in respect of rainfall data.

879.

It is worth noticing that, despite full knowledge about the availability of such processed daily rainfall data by India Meteorological Department, none of the three States chose to use this data nor referred to in their respective written

submissions.

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In view of above, in order to facilitate the learned

Senior Counsels of the party States, to examine the daily gridded

0.25°x0.25° rainfall data and offer their comments, a soft copy of the data as procured by the Tribunal from India Meteorological Department, was made available to them for their study. Learned Senior Counsels of the party States were directed to indicate as to: (a) why the daily gridded 0.25°x0.25° rainfall data of the India Meteorological Department has not been used by the State; (b) why the daily gridded 0.25°x0.25° rainfall data of the India Meteorological Department cannot be used for the assessment of yield of Mahadayi basin; and (c) whether it would be possible for the State to use the daily gridded 0.25°x0.25° rainfall data of the India Meteorological Department and re-assess the water availability before the conclusion of arguments by the learned Senior Counsel / learned Counsel of the party States i.e., before 22.2.2018.

881.

In response, the State of Goa as well as the State of Karnataka have used the daily gridded 0.25°x0.25° rainfall data to: (a) develop the regression equations; and (b) re-assess the water availability. The regression equation developed by the

State of Goa is “Runoff = 0.7904*Rainfall – 219.619” and produced the same before the Tribunal (Volume 237-D). The regression equation developed by the State of Karnataka is “Y =

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0.981X – 269.2", where Y is runoff in mm and X is rainfall in mm (Volume 238A).

882.

The State of Goa has, however, stated at page 11 of the "Para -wise Reply of the State of Goa to the Points Raised on 09.02.2018 by this Hon'ble Tribunal regrading Inconsistency in the Rainfall Data" (Vol ume 237D) as under.

"Goa does not agree with Prof. Gosain that the grid data can be used to check the consistency of the station data. Dr. S Pai, is the Scientist F and Head, Climate Prediction, Climate Research Division, IMD. A paper by him and his colleague was included in the grid data handed over by this Hon'ble Tribunal. Goa wrote an email to Dr. Pai regarding use of this data. The query sent, and Dr. Pai's reply are enclosed. It is clear that if sufficiently long series of station data is available, and in Mahadayi it is thus available, then station data is the better option. Grid data is useful for situations where adequate station data is not available."

883.

The Tribunal finds that the reply of Dr. S. Pai to the e-mail sent to him by Shri Chetan Pandit (which has been enclosed by the State of Goa), is as under.

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"… If you have long times series of good quality stations data ,this may better than gridded data. At the same time you can use both and compare the results for common period and if they match well you can use gridded data as the same is available from 1901 onwards."

[Emphasis supplied]

884.

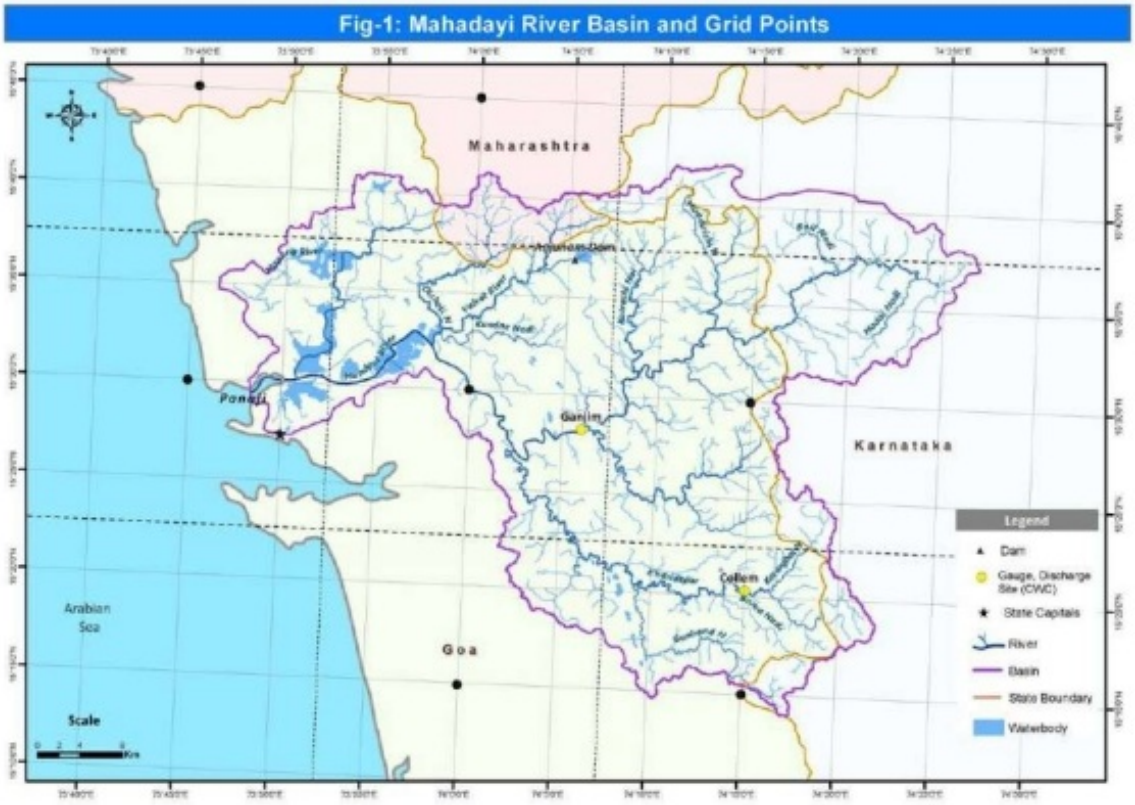
What is worth noticing is that Shri Pai has made very specific reference to good quality station data. The main reason for the Tribunal for not accepting the data of various rain gauge stations included in different reports filed by the party States, is the inconsistencies noticed in the station data and not the length of the data. Obviously, the data with such inconsistencies cannot be regarded as "good quality stations data".

885.

Accordingly, the Tribunal has decided to use the "High Spatial Resolution (0.25°x0.25°) Long Period Daily Gridded Rainfall Data" from IMD. The data supplied by IMD includes daily

processed rainfall values at various Grid Points for the years from 1901 to 2013. After due examination, the Grid Points in and around the Mahadayi river basin were selected as the Grid Points which are located on west of the Sahayadri Hill Ranges are used for the assessment of the water availability of Mahadayi basin. In

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view of orographic features, the Grid Points on the east of the Sahayadri Hill Ranges were not considered being in the rain shadow area.

886.

Seven Grid Points i.e. (a) 74°E 15°15'N, (b) 74°15'E 15°15'N, (c) 73°45'E 15°30'N, (d) 74°E 15°30'N, (e) 74°15'E 15°30'N, (f) 73°45'E 15°45'N and (g) 74°E 15°45'N are thus selected. The location of the selected seven Grid Points, vis-à-vis, the catchment area of Mahadayi river basin are shown in Fig. 1.

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Analysis of the Data to Assess the Average Annual Rainfall over the Basin

887.

The daily rainfall values at the seven Grid Points are used by the Tribunal to compute the monthly values of the rainfall, which were further added to estimate the values of the annual rainfall for each year starting from year 1901-02 to 2012-13.

888.

Annual average rainfall over the Mahadayi basin has been computed by using the Thiessen weight of the seven Grid Points and the annual average rainfall over the entire Mahadayi river basin with catchment area of 2032 sq.km. has, accordingly, been computed by the Tribunal and the annual values for 112 years from 1901-02 to 2012-13 are given in Table-3.

Table-3: Estimation of Average Annual Rainfall over Mahadayi River Basin

	Annual Rainfall (in mm) at Grid Points in Mahadayi Basin					

Year	74°E 15°15'N (Thiessen Weight = 0.0317)	74°15'E 15°15'N (Thiessen Weight = 0.1470)	73°45'E 15°30'N (Thiessen Weight = 0.0566)	74°E 15°30'N (Thiessen Weight = 0.2704)	74°15'E 15°30'N (Thiessen Weight = 0.4218)	73°4 15°4 (Thie Weig 0.00
1	2	3	4	5	6	7
1901-02	2356.9	2262.1	2544.2	3610.9	2409.0	3115

1902-03	3256.0	2218.7	3515.6	3188.4	1968.7	3749.9	3008.6	25
1903-04	2491.3	1880.7	2612.7	2434.3	1682.0	3286.3	2630.1	20
1904-05	2519.7	2057.9	2692.5	2475.1	1798.9	3106.1	2849.6	21
1905-06	1572.7	1219.8	1572.1	1519.4	1053.3	1784.8	1674.4	12
1906-07	2200.3	1757.6	2310.0	2126.6	1479.8	2770.6	2321.6	18
1907-08	2450.2	2696.8	2270.1	2244.6	2120.9	2979.7	2952.4	23
1908-09	2803.0	2244.8	2836.3	2660.4	1834.4	3611.3	3146.1	23
1909-10	2161.5	1813.1	2261.2	2071.1	1536.6	3316.9	2757.1	18
1910-11	2293.8	1823.1	2378.3	2179.0	1536.4	2833.3	2397.0	18

1911-12	2006.2	1893.4	1996.4	1917.7	1552.4	2445.7	2307.6	17
1912-13	2640.0	2509.1	2737.3	2616.4	2267.2	3643.5	3451.3	25
1913-14	2314.3	1862.9	2385.9	2233.3	1502.8	2710.1	2367.4	18
1914-15	3240.9	3151.6	3167.8	3114.6	2823.5	3840.0	3885.6	30
1915-16	2308.7	1608.3	2619.7	2300.9	1434.5	2865.5	2518.2	18
1916-17	3077.0	2076.8	3340.4	2918.0	1560.4	4075.6	3094.6	22
1917-18	3428.9	2414.6	3573.4	3209.4	1800.7	4135.5	3323.2	25
1918-19	1410.8	1154.8	1391.6	1331.1	880.4	2002.3	1659.8	11
1919-20	2427.0	2080.1	2352.7	2272.0	1557.4	2938.7	2693.5	19
1920-21	1918.9	1970.2	1763.4	1785.1	1524.2	2186.7	2256.0	17

1921-22	2331.9	2093.1	2358.3	2211.7	1623.6	2968.7	2746.3	19
1922-23	2585.0	2173.4	2732.2	2395.6	1552.4	3454.1	3015.1	20
1923-24	2839.3	2910.9	2639.0	2632.2	2291.8	3219.6	3291.4	25
1924-25	2636.9	2388.2	2669.1	2491.3	1945.0	3196.9	2939.8	22
1925-26	2205.9	2168.8	2110.0	2052.4	1773.6	2730.6	2727.2	20
1926-27	2304.4	2283.4	2201.3	2280.6	1979.5	3026.4	3106.5	22
1927-28	2121.7	2309.6	1893.6	2051.0	1970.0	2853.0	2846.3	21
1928-29	3885.2	3105.7	2873.3	3681.9	3032.3	3634.4	3163.3	32
1929-30	3652.1	2940.9	3218.4	3626.1	2969.4	3206.9	3004.6	31
1930-31	3392.0	2843.4	2619.4	3688.7	2903.4	2159.6	2950.5	31

1931-32	5130.7	3825.2	3780.0	4984.8	3876.0	4214.9	4050.5	42
1932-33	3894.9	3237.6	3471.7	4120.1	3283.2	3469.1	3634.5	35
1933-34	4005.2	3368.5	2840.3	4315.1	3484.7	3412.9	3658.7	36
1934-35	4013.3	3355.3	2794.5	3916.1	3379.3	3514.2	3256.7	35
1935-36	3039.7	2403.6	2165.1	2868.9	2287.3	2527.6	2222.2	24
1936-37	3627.1	2871.1	2563.8	3400.9	2702.2	3681.4	3068.1	29
1937-38	3815.6	3031.4	2830.8	3592.1	2907.9	4277.2	3123.2	31
1938-39	3783.4	3159.2	2293.9	3758.3	3027.1	3077.4	3105.4	32
1939-40	3413.9	3069.3	2093.5	3622.6	3142.1	3452.2	3427.3	32
1940-41	4356.4	3360.2	3005.5	3601.2	2925.5	3918.0	3290.6	32

1941-42	2312.9	2477.4	1552.3	2472.2	2155.5	1748.9	2357.6	22
1942-43	4741.7	3193.1	3769.7	3806.7	2846.0	3871.6	3435.0	33
1943-44	3405.4	2616.0	2597.5	2957.4	2209.7	3123.4	2843.6	25
1944-45	3051.6	2452.2	1970.3	2746.8	2257.9	2879.9	2753.2	24
1945-46	4128.5	2854.3	3017.5	3973.7	2730.0	3531.8	3287.4	31
1946-47	3900.0	3231.4	2621.2	3849.7	3061.0	3176.0	3588.4	33
1947-48	4075.9	2796.2	2549.5	3831.7	2552.8	3186.8	2979.0	30
1948-49	4342.6	3000.5	3317.0	4107.7	2791.4	3532.6	3455.1	33
1949-50	2051.9	2094.4	2539.9	4291.9	2400.6	3147.9	3054.1	29
1950-51	4612.3	3541.3	2582.5	5095.5	3516.6	3763.5	3964.7	39

1951-52	4137.3	2621.7	2678.9	3453.5	2425.0	2513.7	2763.4	28
1952-53	3245.8	2546.1	2113.4	3834.7	2697.0	3537.4	3327.6	30
1953-54	4091.9	3517.6	3376.2	4668.5	3517.9	3970.2	4127.7	38
1954-55	4264.9	3017.8	3471.2	5282.0	3285.4	4184.6	3963.2	38
1955-56	4326.4	2695.7	3745.6	4492.6	2796.0	4284.9	3237.1	33
1956-57	4101.2	3295.5	3126.4	4603.8	3249.5	3549.3	3635.3	36
1957-58	3354.6	2745.9	2759.8	4633.3	3082.4	3628.8	3689.7	34

1958-59	3994.9	3453.6	3463.6	4892.1	3422.3	4059.3	4049.2
1959-60	4522.1	3682.5	3441.1	5770.1	3914.4	3808.5	4486.3
1960-61	4166.1	3004.1	3275.5	4476.0	2886.6	3550.1	3265.5
1961-62	4527.8	3736.3	4140.2	5753.4	3896.6	4308.2	4843.5
1962-63	1000.9	2598.3	2444.8	800.3	1117.2	1719.9	959.2
1963-64	2967.4	2338.2	2990.0	3821.7	2444.9	3891.3	3608.9
1964-65	2919.6	2919.1	2927.7	3923.7	2434.9	4105.2	2701.1
1965-66	3925.7	2952.4	3154.1	4028.7	2133.6	2975.9	2894.3
1966-67	2679.9	2857.0	2339.5	3516.6	2231.2	2560.5	2093.3
1967-68	2727.1	1954.0	2720.4	3990.5	1399.6	2741.2	3260.6
1968-69	3915.8	2625.0	2509.9	3842.4	2005.8	2954.8	2470.8
1969-70	4727.7	3080.4	2815.7	4000.8	2362.1	3438.3	2696.8

1970-71	6057.6	3370.5	3233.0	4617.4	2284.6	3952.4	2982.4
1971-72	1955.9	1654.6	2460.4	2112.1	1688.5	2523.8	1895.6
1972-73	2010.0	2413.8	1752.2	1917.6	1724.0	2464.1	2002.9
1973-74	3376.9	3497.3	3041.6	3772.9	2260.3	2985.2	2094.7
1974-75	4318.0	3443.7	3215.4	3885.4	1925.8	3334.1	2078.0
1975-76	4700.7	3087.7	3141.1	4835.9	2890.8	3817.1	3827.6
1976-77	2332.5	2063.6	2747.9	2315.2	2062.2	2379.8	1930.8
1977-78	2856.1	2191.0	3081.5	4315.7	2341.5	3942.5	4974.9
1978-79	2559.0	3273.6	2685.2	5362.2	3101.9	3148.4	6133.4
1979-80	2952.8	3170.4	2290.5	3838.0	3276.3	2561.1	4737.3
1980-81	3233.4	3391.3	2606.0	6595.3	3812.8	2953.6	6789.8
1981-82	4642.7	4270.0	3361.8	4788.6	4534.2	4134.4	5611.3
1982-83	4186.6	5615.4	3099.6	4704.7	4129.3	3673.3	4981.4
1983-84	4407.0	4052.9	3731.7	4846.3	3831.2	4391.5	4868.7

1984-85	3510.1	4159.6	2586.1	3876.6	3501.7	3157.2	4329.7
1985-86	3899.1	4518.4	2919.5	3640.4	2935.4	3547.1	3710.6
1986-87	2795.4	3107.4	1805.9	3150.7	3314.2	1937.4	3206.9
1987-88	2900.4	3319.0	2763.3	3548.9	2897.2	2889.5	3253.5
1988-89	3748.1	2978.5	3054.0	5567.3	4616.4	3012.4	4619.8
1989-90	3511.2	3400.4	2917.9	4106.1	3804.5	2858.2	4381.7
1990-91	3750.8	4004.3	2434.1	4673.8	5070.5	2973.1	5006.6
1991-92	3290.7	4258.0	2147.7	3696.1	4365.0	2562.1	4310.3
1992-93	3844.1	4193.2	2742.7	4197.0	4247.0	3058.3	4659.7
1993-94	3313.3	3775.6	2506.2	4607.5	4310.4	2851.5	5058.5
1994-95	4068.1	6354.7	2920.8	5976.8	6270.1	3232.7	6444.4
1995-96	3573.8	3242.0	3475.3	3671.2	3340.5	3557.9	3139.4
1996-97	3296.3	4134.6	3103.4	3841.5	3725.8	3392.3	3401.5

1997-98	4042.1	4684.9	3483.4	5026.6	5204.7	3665.7	5699.7
1998-99	4866.8	4107.9	3285.3	4978.1	3241.6	3581.7	4603.0
1999-00	4245.4	3854.6	3673.2	4772.6	4607.9	3755.7	5276.5
2000-01	4424.4	3655.6	3347.6	4115.6	3762.8	3385.4	4233.4
2001-02	3082.1	2771.0	2001.9	3192.2	3342.7	2469.3	3752.3
2002-03	2788.4	2811.5	2189.5	3448.9	3225.2	2582.6	3858.7
2003-04	3354.9	3212.2	2804.7	3644.5	4359.2	3176.0	3087.3
2004-05	2803.4	3570.1	2044.2	3053.6	4865.7	2616.2	2077.4
2005-06	3554.8	3880.6	3771.0	4751.7	4232.7	3317.8	4249.6
2006-07	5917.5	3907.0	2620.3	6801.1	5300.4	2994.2	6072.4
2007-08	3916.7	4134.8	3630.7	5062.1	5126.5	3560.1	5180.1
2008-09	4832.6	3491.9	2829.9	4603.7	4310.5	2680.3	4172.8
2009-10	3939.4	3936.5	3180.7	4219.4	4241.2	3728.2	4638.8
2010-11	4072.2	2575.4	3744.7	4752.6	3093.5	4328.9	3421.9

2011-12	4270.2	4429.9	3172.8	5016.8	4708.9	3989.1	3814.8
2012-13	3442.1	3409.3	2864.0	4169.7	3733.6	3518.9	3093.4
Average	**3399.8**	**3007.7**	**2785.3**	**3700.8**	**2900.2**	**3248.0**	**3477.3**

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Length of the Data to be used for Analysis

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The Tribunal notices that varying length of data sets have been used in different Reports by the Experts for the purpose of development of Rainfall-Runoff model i.e., the linear regression equation and for generation of runoff series to be used for assessment of water availability, at different dependability, of the Mahadayi river basin.

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Though the Tribunal has decided not to utilize the CWC Report of 2003, limited information in respect of length of data, used for analysis is mentioned, only for the purpose of examining the length of the data necessary for assessment of water availability. In the Report of CWC of 2003 (Volume 15), the rainfall and runoff data set of 10 years i.e., for the years 1979-80, 1985-86 to 1987-88, 1989-90, 1991-92 to 1994-95 and 1997-98, have been used for development of Rainfall-Runoff model and rainfall data of 70 years, (from 1928-29 to 1997-98) have been used for generation of runoff series to assess the water

availability of the Mahadayi river basin at 75% dependability and 50% dependability.

1412

891.

In the Report of Prof. A. K. Gosain of August 2015 (Volume 166), the rainfall and runoff data set of 25 years i.e., for the years 1979-80, 1981-82, 1985-86 to 1987-88, 1889-90, 1991-92 to 1998-1999, 2000-01 to 2005-06, 2007-08 to 2009-10, and 2012-13, have been used for development of Rainfall-Runoff model and rainfall data of 85 years (from 1928-29 to 2012-13), have been used for generation of runoff series to assess the water availability of the Mahadayi river basin at 75% dependability and 50% dependability.

892.

In the Report of Prof. A. K. Gosain of May 2017 (Volume 198 & 198A), the rainfall and runoff data set of 34 years (from 1979-80 to 2012-13) have been used for development of Rainfall-Runoff model and rainfall data of 85 years (from 1928-29 to 2012-13), have been used for generation of runoff series to assess the water availability of the Mahadayi river basin at 75% dependability and 50% dependability.

893.

Shri Chetan Pandit, in his Report of August 2016
(Volume 191) has used the rainfall and runoff data set of 27 years
(from 1979 to 2005) for development of Rainfall-Runoff model
and rainfall data of 42 years (from the 1964 to 2005) have been

used for generation of runoff series to assess the water availability of the Mahadayi river basin at 75% dependability and 50% dependability.

894.

Shri S. N. Huddar, Expert Witness of the State of Maharashtra in his Report of September 2015 [Volume 163(a)] has not used the rainfall data. Instead, he has used the runoff series derived on the basis of the observed discharge data at Virdi Gauging Station of the State of Maharashtra, for 25 years (from 1986 to 2004 and from 2005 to 2011) for assessment of (a) water availability at 75% dependability, (b) water availability at 50% dependability and (c) average annual water availability for the Maharashtra portion only.

895.

Thus, the Experts have used different length of data (a) varying from 10 years to 34 years for development of Rainfall-Runoff model, and (b) varying from 25 years to 85 years for generation of runoff series to assess the water availability at different dependabilities.

896.

The Tribunal has noticed that none of the Reports

filed by the States have undertaken the studies in respect of

external consistency checks and that related to checking the presence of trend in the data series and applied the corrections to address the presence of trend, wherever necessary. In this regard, Shri S. N. Huddar, was asked question No. 13 regarding the trend analysis and need for applying corrections for trend by the Tribunal on 14.11.2017. The specific question and answer to the question by Shri Huddar are reproduced hereunder.

“Q.No.13.

…

a. Why necessary investigations, particularly those related to trend analysis in the data, were not undertaken by you before development of Rainfall-Runoff Equation and accepting the same as correct?

b. Keeping in view the presence of rising trend in the rainfall data, would it be appropriate to use the past data i.e., data for the period from 1928 to 1978 without applying necessary corrections for the same?

Ans. Para wise reply is as under:

(a). As already stated in answer to previous question, I

have restricted my scope to checking of the equation developed by the CWC, and hence, no independent investigation was done by me.

(b). At present Hydrologists use the past record to the extent, which is readily available. Of course, it would be desirable to use the data after applying necessary correction for the same."

1415

897.

The Trib unal finds that the “Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects” of the Government of India, Ministry of Water Resources published in 2010 provides for use of a maximum of 40 years of data for hydrologica l studies. The document “Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects” of the Government of India, Ministry of Water Resources published in 2010 was shown to both Shri Chetan Pandit as well as Prof. Gosain during their cross examination and is marked as MARK-5. Regarding the length of the data, specific question was also put to Prof. Gosain by the Tribunal. The question No. 33 and the reply thereof are reproduced hereunder.

“Q.No.33. The Chapter II of the “Guidelines for Preparation of Detailed Project Report of Irrigation and Multipurpose Projects”, of the Ministry of Water Resources, already on record as MARK-5, and a copy of which has already been handed over to you, suggests

the time unit and length of the data required for hydrological analysis. For a complex system, the minimum length of data required for simulation has been suggested as 40 years. We find that at the time of preparation of your Report, observed hydrological data of about 34 years were available. You have extended the series to about 85 years, from the year 1928 to 2012, by

using long term rainfall data, and linear regression equation, developed for the purpose.

Why do you feel the need for extending the series for 85 years, and not restrict it only to about 40 years, which could be considered as adequate, as per the Guidelines?

Ans. In the document, MARK-5, made available to me, the 40 years recommended length of data is with respect to A4 type of projects. For type A3, the recommended length is 25 years. I would also like to refer to the document MARK-1, (Annex 2.4 on page A2.1-11, thereof), rainfall-runoff correlation method has been suggested even for short term data of 5 to 10 years, at para 2. Therefore, although the requirement of a data is associated with the type of the specific project in question, and that is the major emphasis of these manuals, the present study is more in terms of evaluating the yield of the basin, without referring to any specific project. For the purpose, a data length of around 30 years is more than reasonable, for developing

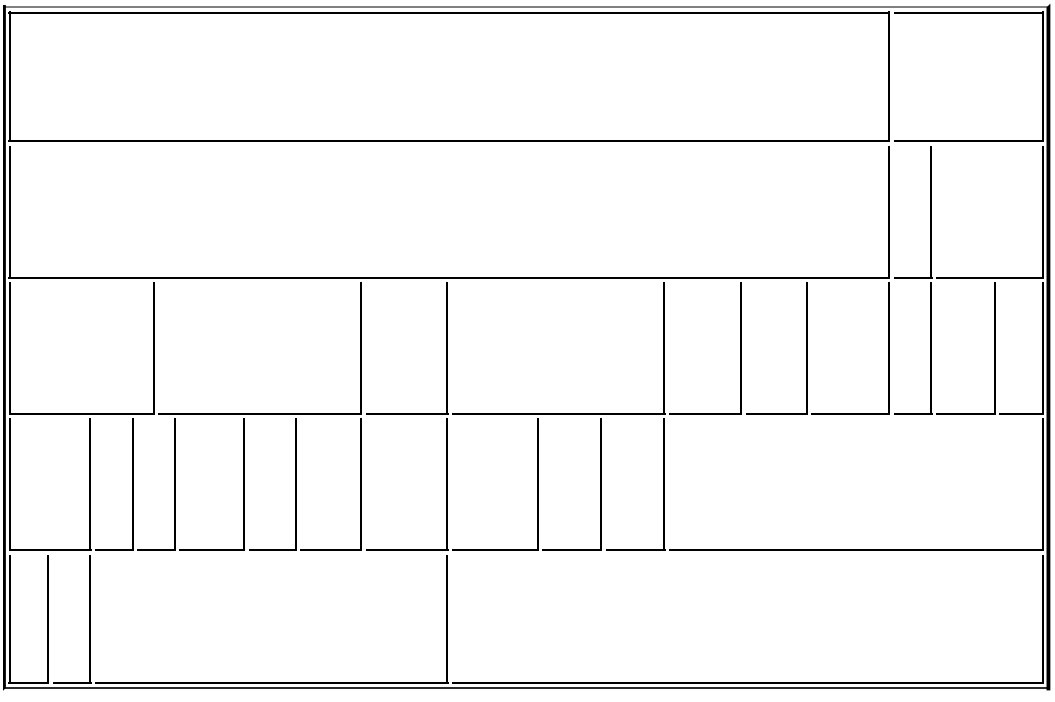
reliable R- R equation.”

898.

In view of above, the series of annual average rainfall values over the Mahadayi basin for 112 years (from 1901-02 to 2012-13) has been analyzed by the Tribunal to examine the presence of trend. The plot of the annual average rainfall of 112 years is shown in Fig.2 below, which clearly indicates a rising trend. Statistical tests were made by the Tribunal as per the

pr ocedure laid down in “Chapter A3 – Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsch of Book 4, Hydrologic Analysis and Interpretation” (MARK -32) to ascertain whether the trend is significant or not. The value of ‘ **t** ’was found to be 10. 22 which is considerably higher than the value of ‘ **tcrit** ’, i.e., 2.6. Thus the trend is significant.

Fig.2: Average Annual Rainfall Over Mahadayi Basin from 1901-02 to 2012-13



4000.0

3000.0

2000.0

1000.0

0.0

Year

899.

In view of the provisions in the “Guidelines for Preparation of Detailed Project Reports of Irrigation and Multipurpose Projects” of the Gov ernment of India, Ministry of Water Resources published in 2010 (MARK-5), a series of 40 years of most recent available data of annual average rainfall over the Mahadayi river basin for the years from 1973-74 to 2012-13 has

been plotted to check the presence of trend, if any, and the same is shown in Fig.3 herein below. The Fig.3 also exhibits presence of rising trend, though with very mild slope. Statistical tests were made as per the procedure laid down in “Chapter A3 – Statistical Methods in Water Resources by D.R. Helsel and R.M. Hirsch of Book 4, Hydrologic Analysis and Interpretation” to ascertain whether the trend is significant or not. This document was shown to Shri S. N. Huddar, Expert Witness for the State of Maharashtra and the same has been marked as MARK- 32 The value of ‘t’ was found to be 2.36 which is less than the value of ‘t crit ’, i.e., 2.6. Thus the trend is insignificant and hence, no correction is needed in the series of 40 years of recent available data of annual average rainfall over Mahadayi river basin as far as ‘trend’ is concerned.

1419

Fig.3: Average Annual Rainfall Over Mahadayi Basin from 1973-74 to 2012-13



use the most recent available data of 40 years (from 1973-74 to 2012-13) of the Annual Average Rainfall over the entire Mahadayi river Basin for generation of the runoff series for assessing the water availability. The daily rainfall data of the seven Grid Points and the average thereof, the computed monthly and annual rainfall data are being reproduced after para 923 of this Report.

Year

In view of above position, the Tribunal has decided to

1420

Transforming the Annual Rainfall into Annual Runoff – Choice of Model

901.

The Tribunal has observed that the model developed and used in different Reports filed by the States of Goa, Karnataka and Maharashtra and that by the Expert Witnesses are simple linear regression equation of the form “Runoff (R) = A x Rainfall (P) + B”. T hus all the models are primarily of the same form. However, the values of the parameters ‘A’ and ‘B’ differ in view of the input values i.e., the values of rainfall and runoff used by the Experts for estimating these parameters.

902.

Simple linear regression equations developed and used by the Experts in their respective Reports are summarized as under.

Sl. No.

1.

2.

Report

Report of CWC of 2003 –

Para 3.3, page 10, Vol. 15

Report of Shri S. N. Huddar

of September 2015 – Para

12, page 34, Vol. 163(a)

Report of Prof. A. K. Gosain

Equation

R = 0.87891 x P – 49.6451

R = 0.8791 x P – 50.106

3.

R = 0.7368 x P + 432.28

1421

of September 2015 – Para

7.4.2, page 43, Vol. 166

4.

Report of Shri Chetan

Pandit of August 2016 –

page 57, Vol. 191

Report of Shri Chetan

Pandit of August 2016 –

Table 33, page 93, Vol. 191

Report of Prof. A. K. Gosain

of May 2017 – Para 3.4.1,

page 6, Vol. 198

Equation developed by the

State of Goa using the

gridded rainfall data and

submitted to the Tribunal

during the arguments

(Page 12, Vol. 237D)

Equation developed by the

State of Karnataka using
the gridded rainfall data
and submitted to the
Tribunal during the
arguments (Page 1, Vol.
238A)

R = 0.689 x P – 115.454

5.

R = 0.692967 x P –
168.195

R = 0.749 x P + 214.2

6.

7.

R = 0.7904 x P – 219.619

8.

R = 0.981 x P – 269.2

903.

As already discussed in the preceding paras, the above mentioned linear regression equations have been derived by using the rainfall and runoff data. The data used by CWC as also

by Prof. Gosain and that by Shri Chetan Pandit are, however, not found reliable due to the reasons explained in earlier paragraphs. Shri S. N. Huddar has used the data of CWC, which is, in itself, not reliable. Therefore, none of the above equations can be considered as reliable and worth adopting for independent analysis and assessment of water availability. The Tribunal has, therefore, no option but to adopt an appropriate empirical formula.

904.

A most commonly used empirical formula which is based on the data of Western Ghats is the Inglis and De Douza Formula, most commonly called as Inglis Formula. The Inglis Formula for Ghat area is: R = 0.85 x P – 305, where values of runoff (R) and precipitation (P) are in mm.

905.

The Tribunal also notes that Inglis Formula is, in fact, included as one of the Rainfall-Runoff models developed for specific regions in India in the Report titled “Development of Hydrological Design Aids (Surface Water) under Hydrology

Project II – State of the Art Report, July 2010” of the Government of India, Ministry of Water Resources, Central Water Commission

1423

[MARK-1]. Relevant Extract from MARK-1 related to Inglis Formula are reproduced as under.

“ ***Inglisand De Souza’s Formula (1946)***

Inglis and De Souza used data from 53 stream gauging sites in Western India. He studied catchments in western ghats and plains of Maharashtra, India and gave the following relationships.

For ghat areas R = 0.85 P – 30.5

….

Where R = runoff (cm)

P = precipitation (cm)”

906.

The State of Goa at Para 154B, page 159 of the Statement of Case of the State of Goa (Volume 131) has, adversely commented about the Inglis Formula that the same is “an empirical outdated and unrealistic formula”. However, the Tribunal finds that the Inglis Formula is, in fact, a simple linear regression equation of the same form which has been derived and used by all the Expert Witnesses for Mahadayi river basin.

907.

Shri Chetan Pandit was asked a specific question relating to estimation of water availability in the event of hydrological and hydro-meteorological data being either inadequate or not at all available. The relevant part of question

No. 153 put to Shri Pandit by the Tribunal on 5.10.2016 and his reply, are reproduced hereunder.

“Q.No.153.

…

c) How will you proceed with the process of estimation of water availability at a specific point along a river for a basin or sub-basin in India when the available hydrological and hydro-meteorological data are not adequate?

d) Is it possible to estimate the availability of water at a specific point along a river for a basin or sub-basin in India if requisite hydrological and hydro-meteorological data are not at all available? If yes, please tell us about commonly used procedures very briefly.

Ans.

c & d) If the inadequacy is so high that even the process of filling a few missing data does not serve the purpose, then the entire approach explained above will have to be changed. The extreme case of inadequate data is – no

data. Many years ago a British Engineer by name Strange developed a Table, which is known as Strange's table which helps determine the water availability based on only a few parameters like the catchment area, mean annual rainfall etc. Such methods are called empirical methods. For other aspects of hydrologic analysis, viz., flood studies etc., there are other empirical formulae available viz., Inglis Formula, Nawab Sher Bahadur Jung Formula etc. These formulae may be used. But empirical formulae will give only a water availability figure without any attached dependability like 50%, 75% etc.

1425

CWC has also done some studies called “Regional Hydrologic Studies” where hydrology of an entire region is studied and this can be used. In short, compromises will have to be made and it will have to be kept in view that the outcome is less reliable.”

908.

Further, in his reply to the question No. 172, put to him by the Tribunal on 5.10.2016, Shri Chetan Pandit, inter-alia, has stated as under.

“… The practice of hydrology continues with rather simple techniques like linear regression for monsoon or annual rainfall and runoff. …”

909.

Similarly Prof. A. K. Gosain, in his reply to question No. 35, put to him by the Tribunal on 14.7.2017 mentioned about the use of Inglis Formula. The question No. 35 and the reply thereof by Prof. Gosain are as under.

“Q.No.35. At Para 4, page 3 of the additional affidavit dated 15.11.2016 (Volume 193), you have mentioned

that “the methods deployed by the respective departments to estimate the water yield have been variable since there is no unique approach that is universally used”.

1426

Please name the various departments and the methods deployed by each of them to estimate the water yield.

Ans. I do not have the record of which Department has used which method for estimating water yield, however, I can tell that the methods employed by the various Departments ranged from empirical relationships, such as Inglis Formula, and Rational method to approaches such as Area Proportion method."

910.

The Tribunal also notices that the State of Goa has used the Inglis Formula for estimation of runoff from rainfall data in the detailed project reports (DPR) of at least 49 proposed projects in Mahadayi basin, namely, (i) Sonal – I [Volume 103(b)], (ii) Sonal [Volume 103(a)], (iii) Shelpi [Volume 103(d)], (iv) Bimbal – I [Volume 103(f)], (v) Ganjem [Volume 103(h)], (vi) Usgao [Volume 103(i)], (vii) Mandovi Nanoda [Volume 103(j)], (viii) Iverkhurd [Volume 103(k)], (ix) Golali [Volume 103(m)], (x) Thane [Volume 103(n)], (xi) Dongurwada [Volume 103(o)], (xii) Thane – I [Volume 103(p)], (xiii) Naneli – I [Volume 103(q)], (xiv) Pale

[Volume 103(r)], (xv) Naneli – II [Volume 103(s)], (xvi) Zarme [Volume 103(t)], (xvii) Ragada – I [Volume 103(u)], (xviii) Ragada – II [Volume 103(v)], (xix) Nandran [Volume 103(w)], (xx) Avardo [Volume 103(x)], (xxi) Nandran – I [Volume 103(y)], (xxii) Jamboli [Volume 103(z)], (xxiii) Satpal [Volume 103(ab)], (xxiv) Fatiyagal

[Volume 103(ac)], (xxv) Ragada – III [Volume 103(ad)], (xxvi) Udalshem [Volume 103(ae)], (xxvii) Kumbharwada [Volume 103(af)], (xxviii) Shivde [Volume 103(ag)], (xxix) Paikul [Volume 103(ah)], (xxx) Melavali [Volume 103(ai)], (xxxi) Sonawali – I [Volume 103(aj)], (xxxii) Sonawali – II [Volume 103(ak)], (xxxiii) Mayda [Volume 103(al)], (xxxiv) Karanzol [Volume 103(am)], (xxxv) Khandepar [Volume 103(an)], (xxxvi) Ghatakwada [Volume 103(ao)], (xxxvii) Nayawada [Volume 103(ap)], (xxxviii) Dongurli [Volume 103(aq)], (xxxix) Kharamol [Volume 103(ar)], (xl) Kharamol – II [Volume 103(as)], (xli) Matujanwada [Volume 103(at)], (xlii) Kajumol [Volume 103(au)], (xliii) Suktoli [Volume 103(av)], (xliv) Tatodi [Volume 103(aw)], (xlv) Nirankal [Volume 103(ax)], (xlvi) Ponsule [Volume 103(ay)], (xlvii) Kodar [Volume 103(az)], (xlviii) Keri [Volume 103(aa)], and (xlix) Advalpal [Volume 103(bb)].

911.

In view of above, the Tribunal decides to use Inglis Formula as a reasonable approach, particularly in view of the fact that the rainfall and the runoff data sets used by the State of Goa

and that by the State of Karnataka cannot be relied upon.

1428

Generation of Annual Runoff Series and Estimation of Water Availability for the Entire Basin

912.

Using the Annual Average Rainfall of 40 years (i.e., from 1973-74 to 2012-13) as given in the Table-3, and adopting the Inglis Formula, annual runoff series of 40 years is generated for the Mahadayi river basin by the Tribunal and the same is shown in Table-4.

Table-4: Computation of Annual Runoff for Mahadayi River Basin

Year	Average Annual Rainfall (in mm) for Entire Mahadayi Basin (2032 sq.km.)	Annual Runoff (in mm) for Entire Mahadayi Basin (2032 sq.km.) - [(Rainfall in Col.2)*0.85 - 305]	Annual Runoff Series for Entire Mahadayi Basin [of Col.3] in Descending Order	Rank No.	Dependability
1	2	3	4	5	6
1973-74	2922.6	2179.2	4746.3	1.0	2.4

1974-75	2844.1	2112.5	4295.2	2.0	4.9
1975-76	3585.1	2742.3	3922.0	3.0	7.3
1976-77	2170.6	1540.0	3806.6	4.0	9.8
1977-78	3097.9	2328.2	3618.5	5.0	12.2
1978-79	3904.5	3013.8	3606.8	6.0	14.6
1979-80	3443.1	2621.7	3593.3	7.0	17.1
1980-81	4615.9	3618.5	3582.0	8.0	19.5
1981-82	4573.0	3582.0	3536.4	9.0	22.0
1982-83	4503.0	3522.6	3528.6	10.0	24.4
1983-84	4224.1	3285.5	3522.6	11.0	26.8

1984-85	3703.2	2842.7	3325.2	12.0	29.3
1985-86	3443.9	2622.3	3285.5	13.0	31.7
1986-87	3124.5	2350.9	3284.7	14.0	34.1
1987-88	3152.2	2374.4	3252.9	15.0	36.6
1988-89	4510.1	3528.6	3223.1	16.0	39.0
1989-90	3802.5	2927.1	3219.0	17.0	41.5
1990-91	4602.1	3606.8	3092.8	18.0	43.9
1991-92	3997.4	3092.8	3083.8	19.0	46.3
1992-93	4150.7	3223.1	3013.8	20.0	48.8
1993-94	4223.1	3284.7	2984.8	21.0	51.2

1994-95	5942.7	4746.3	2927.1	22.0	53.7
1995-96	3417.7	2600.0	2912.8	23.0	56.1
1996-97	3744.8	2878.1	2891.3	24.0	58.5

1997-98	4973.0	3922.0	2878.1	25.0	61.0
1998-99	3986.8	3083.8	2842.7	26.0	63.4
1999-00	4519.2	3536.4	2840.7	27.0	65.9
2000-01	3870.4	2984.8	2742.3	28.0	68.3
2001-02	3158.0	2379.3	2722.3	29.0	70.7
2002-03	3192.8	2408.9	2622.3	30.0	73.2
2003-04	3785.7	2912.8	2621.7	31.0	75.6
2004-05	3760.3	2891.3	2600.0	32.0	78.0
2005-06	4270.9	3325.2	2408.9	33.0	80.5
2006-07	5412.0	4295.2	2379.3	34.0	82.9
2007-08	4837.2	3806.6	2374.4	35.0	85.4
2008-09	4185.8	3252.9	2350.9	36.0	87.8

2009-10	4145.8	3219.0	2328.2	37.0	90.2
2010-11	3561.6	2722.3	2179.2	38.0	92.7
2011-12	4586.2	3593.3	2112.5	39.0	95.1
2012-13	3700.8	2840.7	1540.0	40.0	97.6
	3941.1	**3045.0**			

913.

The Table-4 also indicates the dependability assigned to each of the values of annual runoff for 40 years by putting the same in descending order. From this Table, (i) the average annual water availability of Mahadayi river basin and (ii) the water availability at 75% dependability, are estimated by the Tribunal as under.

Description	**Water availability (in mm / Mcum / tmc)**
Average annual water availability of Mahadayi river basin (for entire catchment area of 2032 sq.km.)	3045.0 mm i.e., 6187.4 Mcum i.e., 218.41 tmc

Water availability of Mahadayi river basin (for entire catchment area of 2032 sq.km.) at 75% dependability	2621.8 mm i.e., 5327.5 Mcum i.e., 188.06 tmc

Assessment of Water Availability (a) For the Catchment Area of Mahadayi river basin in the State of Karnataka, (b) For the Catchment Area of Mahadayi river basin in the State of Maharashtra, and (c) For various project Sites in the States of Karnataka and Maharashtra

914.

As in the case of entire Mahadayi river basin, the water availability has also been assessed for (a) the catchment area of Mahadayi river and its tributaries in the State of Karnataka, (b) the catchment area of tributaries of Mahadayi river basin in the State of Maharashtra, and (c) the catchment areas of the proposed project Sites in the States of Karnataka and Maharashtra by using the same approach viz., (i) using the rainfall values of recent 40 years (from 1973-74 to 2012-13) estimated by IMD at the concerned Grid Points, and (ii) applying Inglis Formula for generation of runoff series. For the proposed project sites in

the territory of Karnataka and Maharashtra, water availability at 90% dependability has also been computed in addition to the

1431

average annual water availability and water availability at 75% dependability.

915.

The specific Grid Point (s), whose rainfall values are used by the Tribunal for the aforesaid purpose, are as under.

Sl. No.	**Details of Catchment Area**	**Corresponding Grid Point (s)**
1.	Catchment area of Mahadayi river and its tributaries in the State of Karnataka (for catchment area of 375 sq.km.)	Grid Points 74°15'E 15°15'N, 74°15'E 15°30'N and 74°E 15°45'N
2.	Catchment area of tributaries of Mahadayi river in the State of Maharashtra (for catchment area of 77 sq.km.)	Grid Point 74°E 15°30'N and 74°E 15°45'N
3.	Kalasa dam (including Haltara and Surla diversion) with catchment area of 25.50 sq.km.	Grid Point 74°15'E 15°30'N
4.	Bhandura dam with catchment area of 32.25 sq.km.	Grid Point 74°15'E 15°30'N
	Kotni dam (including Bhandura dam	

5.	catchment and diversion of Irti, Bailnadi) with catchment area of 125.44 sq.km.	Grid Point 74°15'E 15°30'N
6.	Kotni dam site (independent	Grid Point 74°15'E

	catchment) with catchment area of 93.19 sq.km.	15°30'N
7.	Bailnadi with catchment area of 32.33 sq.km.	Grid Point 74°15'E 15°30'N
8.	Irti dam site with catchment area of 8.78 sq.km.	Grid Point 74°15'E 15°30'N
9.	Irti Pick-up dam (independent catchment) with catchment area of 9.91 sq.km.	Grid Point 74°15'E 15°30'N
10.	Katla-Palna diversion with catchment area of 22.50 sq.km.	Grid Point 74°15'E 15°15'N
11.	Diggi diversion with catchment area of 15.60 sq.km.	Grid Point 74°15'E 15°15'N
12.	Viranjole diversion with catchment area of 9.50 sq.km.	Grid Point 74°15'E 15°30'N
13.	Virdi Large Minor Irrigation Project of Maharashtra with catchment area of 8.25 sq.km.	Grid Point 74°E 15°45'N

The rainfall values related to (a) the catchment area of Mahadayi river and its tributaries in the State of Karnataka, and (b) the catchment area of tributaries of Mahadayi river basin in the State of Maharashtra have accordingly been computed and the same are shown in Table-5. The Table-5 also indicates the corresponding values of the runoff computed by using Inglis

Formula and the percentile dependability value associated with

each value of the runoff.

Table-5: Annual Runoff from Catchment Areas of Mahadayi River Basin in Territory of Karnataka and

Maharashtra

Year	Average rainfall over basin area in Karnataka - Weighted av. of rain at GP 74°15'E 15°15'N, 74°15'E 15°30'N & 74°E 15°45'N	Average rainfall over basin area in Maharashtra - Weighted av. of rain at GP 74°E 15°30'N & 74°E 15°45'N	Annual Runoff for basin area in Karnataka - [(Col.2)*0.85 - 305]	Annual Runoff for Basin Area in Maharashtra - [(Col.3)*0.85 - 305]	Annual Runoff Series o Karnata Area (C 4) in Descen Order
1	2	3	4	5	6
1973-74	2395.1	2279.3	1730.9	1632.4	5034.8
1974-75	2096.6	2276.8	1477.1	1630.3	4078.7

1975-76	2926.7	3938.5	2182.7	3042.7	4076.3
1976-77	2060.4	1973.1	1446.3	1372.1	3959.6
1977-78	2364.3	4902.4	1704.7	3862.0	3903.5
1978-79	3166.4	6048.6	2386.5	4836.3	3673.1
1979-80	3286.5	4638.4	2488.5	3637.6	3659.8
1980-81	3810.7	6768.4	2934.1	5448.1	3549.2
1981-82	4521.0	5520.8	3537.9	4387.7	3537.9
1982-83	4307.0	4951.0	3356.0	3903.3	3464.4
1983-84	3871.4	4866.2	2985.7	3831.3	3394.5
1984-85	3587.1	4279.9	2744.1	3332.9	3356.0

1985-86	3122.7	3702.9	2349.3	2842.4	3317.9
1986-87	3289.6	3200.7	2491.2	2415.6	3305.1
1987-88	2949.4	3286.0	2202.0	2488.1	3279.9
1988-89	4434.6	4724.0	3464.4	3710.4	3276.3
1989-90	3768.3	4351.4	2898.1	3393.7	3275.9
1990-91	4951.2	4970.0	3903.5	3919.5	3259.8
1991-92	4352.3	4242.7	3394.5	3301.3	2985.7
1992-93	4247.2	4608.8	3305.1	3612.5	2934.1
1993-94	4262.3	5008.9	3317.9	3952.6	2898.1
1994-95	6282.1	6393.0	5034.8	5129.0	2896.4

1995-96	3326.6	3197.9	2522.6	2413.2	2889.3
1996-97	3766.3	3449.9	2896.4	2627.4	2829.8
1997-98	5154.4	5625.7	4076.3	4476.8	2744.1
1998-99	3358.2	4644.3	2549.5	3642.6	2549.5
1999-00	4534.3	5221.1	3549.2	4132.9	2522.6
2000-01	3758.0	4220.4	2889.3	3282.4	2491.2
2001-02	3285.4	3690.7	2487.6	2832.1	2488.5
2002-03	3188.8	3813.6	2405.5	2936.6	2487.6

1434

2003-04	4212.8	3148.6	3275.9	2371.3	2405.5	2627.4	31	75.
2004-05	4680.1	2184.8	3673.1	1552.1	2386.5	2488.1	32	78.
2005-06	4193.9	4304.8	3259.8	3354.1	2349.3	2425.0	33	80.
2006-07	5157.3	6152.6	4078.7	4924.7	2279.8	2415.6	34	82.
2007-08	5017.2	5167.1	3959.6	4087.1	2202.0	2413.2	35	85.
2008-09	4217.6	4220.2	3279.9	3282.2	2182.7	2371.3	36	87.
2009-10	4213.3	4592.7	3276.3	3598.8	1730.9	1632.4	37	90.
2010-11	3040.9	3568.3	2279.8	2728.0	1704.7	1630.3	38	92.
2011-12	4664.5	3947.0	3659.8	3050.0	1477.1	1552.1	39	95.
2012-13	3688.0	3211.8	2829.8	2425.0	1446.3	1372.1	40	97.
Average	**3837.8**	**4269.6**	**2957.1**	**3335.0**				

917.

Table-6

shows

the

annual

rainfall

values

of

corresponding Grid Point(s) related to various identified projects

in Mahadayi river basin in the State of Karnataka, the

corresponding values of runoff computed by using Inglis Formula,

and the percentile dependability value associated with each

value of the computed runoff.

Table-6: Annual Runoff for Proposed Projects in Mahadayi River Basin in the State of Karnataka

Year	Average Annual Rainfall (in mm) for Projects at Kalasa, Bhandura, Kotni, Bailnadi, Irti & Viranjole (Grid Point	Average Annual rainfall (in mm) for Projects at Katla-Palna & Diggi (Grid Point 74°15'E 15°15'N)	Annual Runoff for Projects at Kalasa, Bhandura, Kotni, Bailnadi, Irti and Viranjole - [(Col.2)*0.85 - 305]	Annual Runoff for Projects at Katla-Palna & Diggi - [(Col.3)* 0.85 - 305]	Annual Runoff for Projects at Kalasa, Bhandura, Kotni, Bailnadi, Irti & Viranjole in Descending Order	Ar Ru mr Pr Ka & De Or

	74°15'E 15°30'N)					
1	2	3	4	5	6	7
1973-74	2260.3	3497.3	1616.3	2667.7	5024.6	50
1974-75	1925.8	3443.7	1331.9	2622.1	4200.3	44
1975-76	2890.8	3087.7	2152.2	2319.5	4119.0	36
1976-77	2062.2	2063.6	1447.9	1449.1	4052.5	35
1977-78	2341.5	2191.0	1685.3	1557.4	4004.9	34
1978-79	3101.9	3273.6	2331.6	2477.6	3830.8	33
1979-80	3276.3	3170.4	2479.9	2389.8	3697.6	33
1980-81	3812.8	3391.3	2935.9	2577.6	3618.9	32
1981-						

82	4534.2	4270.0	3549.1	3324.5	3611.7	32
1982-83	4129.3	5615.4	3204.9	4468.1	3549.1	32
1983-84	3831.2	4052.9	2951.5	3140.0	3405.3	32
1984-85	3501.7	4159.6	2671.4	3230.7	3400.3	31

1985-86	2935.4	4518.4	2190.1	3535.6	3358.9	3140.0	13	31.
1986-87	3314.2	3107.4	2512.1	2336.3	3358.8	3098.7	14	34.
1987-88	2897.2	3319.0	2157.6	2516.2	3305.0	3041.0	15	36.
1988-89	4616.4	2978.5	3618.9	2226.7	3300.0	3016.0	16	39.
1989-90	3804.5	3400.4	2928.8	2585.3	3292.8	2993.5	17	41.
1990-91	5070.5	4004.3	4004.9	3098.7	3204.9	2971.4	18	43.
1991-92	4365.0	4258.0	3405.3	3314.3	2951.5	2904.3	19	46.
1992-93	4247.0	4193.2	3305.0	3259.2	2935.9	2802.3	20	48.
1993-94	4310.4	3775.6	3358.8	2904.3	2928.8	2729.6	21	51.
1994-95	6270.1	6354.7	5024.6	5096.5	2893.4	2667.7	22	53.
1995-96	3340.5	3242.0	2534.4	2450.7	2868.6	2663.1	23	56.
1996-97	3725.8	4134.6	2861.9	3209.4	2861.9	2622.1	24	58.

1997-98	5204.7	4684.9	4119.0	3677.2	2671.4	2592.9	25	61.
1998-99	3241.6	4107.9	2450.4	3186.7	2536.3	2585.3	26	63.
1999-00	4607.9	3854.6	3611.7	2971.4	2534.4	2577.6	27	65.
2000-01	3762.8	3655.6	2893.4	2802.3	2512.1	2516.2	28	68.
2001-02	3342.7	2771.0	2536.3	2050.4	2479.9	2477.6	29	70.
2002-03	3225.2	2811.5	2436.4	2084.8	2450.4	2450.7	30	73.
2003-04	4359.2	3212.2	3400.3	2425.4	2436.4	2425.4	31	75.
2004-05	4865.7	3570.1	3830.8	2729.6	2331.6	2389.8	32	78.
2005-06	4232.7	3880.6	3292.8	2993.5	2324.5	2336.3	33	80.
2006-07	5300.4	3907.0	4200.3	3016.0	2190.1	2319.5	34	82.
2007-08	5126.5	4134.8	4052.5	3209.6	2157.6	2226.7	35	85.
2008-09	4310.5	3491.9	3358.9	2663.1	2152.2	2084.8	36	87.
2009-10	4241.2	3936.5	3300.0	3041.0	1685.3	2050.4	37	90.
2010-11	3093.5	2575.4	2324.5	1884.1	1616.3	1884.1	38	92.

2011-12	4708.9	4429.9	3697.6	3460.4	1447.9	1557.4	39	95.
2012-13	3733.6	3409.3	2868.6	2592.9	1331.9	1449.1	40	97.
Average	**3848.1**	**3698.4**	**2965.8**	**2838.6**				

918.

The values of average annual water availability and the water availability at 75% dependability for (a) the catchment area of Mahadayi river and its tributaries in the State of Karnataka and (b) the catchment area of tributaries of Mahadayi river basin in the State of Maharashtra has been computed by the Tribunal as under.

Sl. No.	**Catchment in States of Karnataka / Maharashtra**	**Average annual water availability (in mm / Mcum / tmc)**	**Water availability at 75% dependability (in mm / Mcum / tmc)**
1.	Catchment area of	2957.1 mm	2426.0 mm

1436

	Mahadayi river and its tributaries in the State of Karnataka (for catchment area of 375 sq.km.)	i.e., 1108.9 Mcum i.e., 39.14 tmc	i.e., 909.8 Mcum i.e., 32.11 tmc
2.	Catchment area of tributaries of Mahadayi river in the State of Maharashtra (for catchment area of 77 sq.km.)	3335.0 mm i.e., 256.8 Mcum i.e., 9.06 tmc	2652.5 mm i.e., 204.2 Mcum i.e., 7.21 tmc

919.

Values of (a) average annual water availability, (b) water availability 75% dependability and (c) water availability at 90% dependability in respect of various proposed projects by the States of Karnataka and Maharashtra have been computed and the results are summarized as under.

Sl. No.	**Various proposed projects in the States of Karnataka and Maharashtra**	**Average annual water availability (in mm / Mcum / tmc)**	**Water availability at 75% dependability (in mm / Mcum / tmc)**	**Water availability at 90% dependability (in mm / Mcum / tmc)**

Proposed Projects in Karnataka				
1.	Proposed Kalasa dam site (including Haltara and Surla diversion) with	2965.8 mm i.e., 75.6 Mcum i.e., 2.67 tmc	2439.9 mm i.e., 62.2 Mcum i.e., 2.19 tmc	1724.2 mm i.e., 43.9 Mcum i.e., 1.55 tmc

	catchment area of 25.50 sq.km.			
2.	Proposed Bhandura dam site with catchment area of 32.25 sq.km.	2965.8 mm i.e., 95.6 Mcum i.e., 3.37 tmc	2439.9 mm i.e., 78.7 Mcum i.e., 2.77 tmc	1724.2 mm i.e., 55.6 Mcum i.e., 1.96 tmc
3.	Proposed Kotni dam site (independent catchment) with catchment area of 93.19 sq.km.	2965.8 mm i.e., 276.4 Mcum i.e., 9.76 tmc	2439.9 mm i.e., 227.4 Mcum i.e., 8.02 tmc	1724.2 mm i.e., 160.7 Mcum i.e., 5.67 tmc
4.	Proposed Kotni dam site (including Bhandura dam catchment and diversion of Irti, Bailnadi) with catchment area of 125.44 sq.km.	2965.8 mm i.e., 372.0 Mcum i.e., 13.13 tmc	2439.9 mm i.e., 306.1 Mcum i.e., 10.80 tmc	1724.2 mm i.e., 216.3 Mcum i.e., 7.63 tmc
5.	Proposed Bailnadi diversion site with catchment	2965.8 mm i.e., 95.9 Mcum i.e.,	2439.9 mm i.e., 78.9 Mcum i.e.,	1724.2 mm i.e., 55.7 Mcum i.e.,

	area of 32.33 sq.km.	3.38 tmc	2.78 tmc	1.97 tmc
6.	Proposed Irti dam site with catchment area of 8.78 sq.km.	2965.8 mm i.e., 26.0 Mcum i.e., 0.92 tmc	2439.9 mm i.e., 21.4 Mcum i.e., 0.76 tmc	1724.2 mm i.e., 15.1 Mcum i.e., 0.53 tmc
7.	Proposed Irti Pick-up dam site (independent catchment) with catchment area of 9.91 sq.km.	2965.8 mm i.e., 29.4 Mcum i.e., 1.04 tmc	2439.9 mm i.e., 24.2 Mcum i.e., 0.85 tmc	1724.2 mm i.e., 17.1 Mcum i.e., 0.60 tmc
8.	Proposed Katla- Palna diversion scheme with catchment area of 22.50 sq.km.	2838.6 mm i.e., 63.9 Mcum i.e., 2.25 tmc	2431.7 mm i.e., 54.7 Mcum i.e., 1.93 tmc	2053.3 mm i.e., 46.2 Mcum i.e., 1.63 tmc

1438

9.	Proposed Diggi diversion scheme with catchment area of 15.60 sq.km.	2838.6 mm i.e., 44.3 Mcum i.e., 1.56 tmc	2431.7 mm i.e., 37.9 Mcum i.e., 1.34 tmc	2053.3 mm i.e., 32.0 Mcum i.e., 1.13 tmc
10.	Proposed Viranjole diversion scheme with catchment area of 9.50 sq.km.	2965.8 mm i.e., 28.2 Mcum i.e., 0.99 tmc	2439.9 mm i.e., 23.2 Mcum i.e., 0.82 tmc	1724.2 mm i.e., 16.4 Mcum i.e., 0.58 tmc
Proposed Project in Maharashtra				
11.	Virdi Large Minor Irrigation Project of Maharashtra on Kattica Nalla with total catchment area of 8.25 sq.km.	3324.1 mm i.e., 27.4 Mcum i.e., 0.97 tmc	2590.6 mm i.e., 21.37 Mcum i.e., 0.75 tmc	1545.8 mm i.e., 12.75 Mcum i.e., 0.45 tmc

920.

It may be noted that the average annual runoff of

3034 mm based on the observed data by the State of Karnataka

at Chapoli gauging site reasonably matches with the assessed

runoff of 2966 mm found by the Tribunal for the catchment area of Mahadayi river and its tributaries in the State of Karnataka (for catchment area of 375 sq.km.). Similarly the runoff of 3324.1 mm assessed by the Tribunal for the catchment area of tributaries of Mahadayi river in the State of Maharashtra (for catchment area of 77 sq.km.) matches reasonably with the average annual runoff of 3252 mm estimated on the basis of observed data at the Virdi gauging site of the State of Maharashtra.

1439

921.

The results of independent study have also been compared in respect of the runoff factor, with the runoff factor indicated in Table 33, page 93 of the “Affidavit of Examination -in-Ch ief of Shri Chetan Pandit” (Volume 191) in respect of the observed runoff data at Ganjim for the years 2001 to 2005, which is considered as correct one, by Shri Pandit and used for his analysis. The runoff factors indicated in Table 33, page 93, Volume 191 by Shri Pandit for the years 2001, 2002, 2003, 2004 and 2005 are 0.7379, 0.6837, 0.7438, 0.8868 and 0.7770 respectively. The average of these five values of runoff factors has been computed by the Tribunal as 0.7658. The average runoff factor in respect of the 40 years of runoff series (for the period from 1973-74 to 2012-13) has also been assessed by the Tribunal using the average annual rainfall value of 3941.1 mm and the average annual runoff value of 3045.0 mm as mentioned in the Table-4. The runoff factor works out to be 0.77 (=3045.0/3941.1), which is quite comparable with the average of the runoff factors of the aforesaid five years adopted by Shri Pandit.

922.

A comparison of the water availability as reported by the party States and as assessed by the Tribunal has been made and summarized hereunder.

1440

I. Water availability for entire Mahadayi basin (catchment area of 2032 sq.km.) at 75% dependability

a.

As per report filed by the State = 198.42 to 206.17 tmc of Karnataka

b. As per report filed by the State = 151.47 to 154.4 tmc of Goa

c.

As per report filed by the State = 208.73 tmc of Maharashtra

d. As assessed by the TRIBUNAL

= 188.06 tmc

II. Water availability for catchment area of 375 sq.km. of Mahadayi basin in Karnataka at 75% dependability

a. As per report filed by the State of Karnataka = 44.15 tmc

b. As assessed by the TRIBUNAL

= 32.11 tmc

III. Water availability for catchment area of 77 sq.km. of Mahadayi basin in Maharashtra at 75% dependability

1441

a.

As per report filed by the State of =

Maharashtra

6.25 to 7.48 tmc

b. As assessed by the TRIBUNAL

=

7.21 tmc

IV. Water availability at 75% dependability (in tmc) in respect of various proposed project sites on Mahadayi or its tributaries in Karnataka

Sl. No.	**Project site**	**As assessed by Karnataka**	**As assessed by Goa**	**As assessed by the TRIBUNAL**
1.	Proposed Kalasa dam site (including Haltara and Surla diversion) with catchment area of 25.50 sq.km.	3.8 tmc	1.98 tmc	2.19 tmc
	Proposed Bhandura dam site with			

2.	catchment area of 32.25 sq.km.	3.7 tmc	1.50 tmc	2.77 tmc
3.	Proposed Kotni dam site (independent catchment) with catchment area of 93.19 sq.km.	10.6 tmc	6.59 tmc	8.02 tmc

4.	Proposed Kotni dam site (including Bhandura dam catchment and diversion of Irti, Bailnadi) with catchment area of 125.44 sq.km.	19.4 tmc	-	10.80 tmc
5.	Proposed Bailnadi diversion site with catchment area of 32.33 sq.km.	3.7 tmc	1.77 tmc	2.78 tmc
6.	Proposed Irti dam site with catchment area of 8.78 sq.km.	0.9 tmc	0.4 tmc	0.76 tmc
7.	Proposed Irti Pick-up dam site (independent catchment) with catchment area of 9.91 sq.km.	1.2 tmc	0.81 tmc	0.85 tmc
8.	Proposed Katla-Palna diversion scheme with catchment area of 22.50 sq.km.	2.5 tmc	1.52 tmc	1.93 tmc

9.	Proposed Diggi diversion scheme with catchment area of 15.60 sq.km.	1.8 tmc	1.05 tmc	1.34 tmc

10.	Proposed Viranjole diversion scheme with catchment area of 9.50 sq.km.	0.8 tmc	0.73 tmc	0.82 tmc

V. Water availability in respect of proposed project site on Kattica Nalla, a tributary of Mahadayi in Maharashtra

a. As per report filed by the State of Maharashtra

b. As assessed by the Tribunal

= 0.80 tmc

= 0.75 tmc

923.

In view of the above, the water availability assessed by the Tribunal and indicated in the aforesaid Para 913, Para 918, and Para 919 are adopted by the Tribunal for further examination of the claims of the three party States.

1444

MONTHLY RAINFALL DATA

FOR THE PERIOD

FROM JUNE 1901 TO MAY 2013

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1901-02						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1044.1	494.9	1428.1	1024.6	557.2	1329
July	674	888	611.5	1267.3	817.3	963.2
August	475	633.3	360.8	1001.8	787.1	574.1
September	79.9	68.1	107	162.1	69.5	155.1
October	42.3	83.8	19.6	88.1	69.9	32.1
November	14.8	19	8.1	22.9	15.8	19
December	3.9	1.1	1.1	16.3	6.7	0.2
January	0	0.1	0	0	0	0
February	0	0	0	0	0	0

March	3.8	12.5	0	0.2	6.1	0.6
April	4.8	17.2	0.3	4.3	14.5	4.8
May	14.3	44.1	7.7	23.3	64.9	37.1
Total	2356.9	2262.1	2544.2	3610.9	2409	3115.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1902-03

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	783.4	329.5	911	800	277.5	779.4
July	1090.9	830.8	1119.3	1072.3	785.3	1316.1
August	322.2	197.4	344.5	315.9	163.2	432.2
September	577.5	316.2	674.7	531.4	198.1	634.3
October	104.1	168.4	66.3	89.7	159.1	106.8
November	81.2	38.6	112.9	87.8	43.4	125.5

December	97.5	172	73.8	105.7	201.2	73.5
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	2.5	0	1.1	4.7	0
May	199.2	163.3	213.1	184.5	136.2	282.1
Total	3256	2218.7	3515.6	3188.4	1968.7	3749.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1903-04						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	536.7	176.9	624.4	540.1	168.4	705.8
July	1086.8	1092.5	1038.3	1036.1	933.2	1544.2
August	510.1	301.3	585.3	472.8	237.5	647.8
September	203.5	122.1	222.9	199.5	100.8	232.3
October	54.8	33.2	63.6	77	60.7	94.5
November	27.4	18	31.3	31.8	27.4	27
December	3.5	3.6	4	4.6	2.2	4.8
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0.1	3.4	0	3.8	3.4	0
April	29.3	36.2	19.8	32.7	47	8.6
May	39.1	93.5	23.1	35.9	101.4	21.3
Total	2491.3	1880.7	2612.7	2434.3	1682	3286.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1904-05

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1091.4	768.3	1191.8	1083.7	669.1	1385
July	889.1	725.2	943.5	848.6	571.2	1061.3
August	241	349.2	205.9	227.2	324.1	323
September	197	88.3	254.2	209.4	87.3	207.7
October	62.8	65.6	65.1	63.9	70.4	112.2
November	0	0.3	0	0	0	0

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0.6	0
April	4.5	20.2	2.1	8.8	29.6	0.7
May	33.9	40.8	29.9	33.5	46.6	16.2
Total	2519.7	2057.9	2692.5	2475.1	1798.9	3106.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1905-06						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	606.4	157	703.6	593.6	127.1	562.4
July	380	604.2	289.1	379.9	531	556.5
August	276.7	189.7	244.5	261.3	150.8	348.5
September	128.7	67.1	164	123.4	42.1	176.8
October	131.1	111.4	127.5	107.6	86.3	114.9
November	24.9	63.9	8	13.6	50.2	5.4
December	0	0	0	0	0	0
January	8.2	10.7	9.5	14.8	21	6.8
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0	1.2	0	0.6	4.1	0
May	16.7	14.6	25.9	24.6	40.7	13.5
Total	1572.7	1219.8	1572.1	1519.4	1053.3	1784.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1906-07

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	600.2	334	680.6	587	269.7	628.2
July	912.2	742	951.6	867.1	594.6	1234.1
August	342.8	262.3	354	347.9	223.3	585.1
September	155.9	111.8	163.4	152	114.6	189
October	81.7	133.8	68.2	71.7	125.3	71.3
November	5.3	7.1	7.8	12.9	16.4	25.5

December	16.4	37.5	7.6	10.5	24.8	2.3
January	9.2	3.7	15.1	9.1	3.6	6.4
February	0	0	0	0	0	0
March	0	1	0	0.6	0.5	0
April	74.8	116.4	61.7	66.1	97.9	28.7
May	1.8	8	0	1.7	9.1	0
Total	2200.3	1757.6	2310	2126.6	1479.8	2770.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1907-08

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	688.7	382.9	760.2	641.5	250.7	777.9
July	852.2	781.7	824.4	782.3	583.7	1122.3
August	654.5	1109.6	500.2	606.5	919.5	812.2
September	178.1	234.3	167.2	180.8	239.6	229.6
October	24.8	48.2	10.8	12.9	24.6	26.8
November	14.3	28.8	2.8	7.7	28.8	3.7
December	1.2	1.3	1.3	0.7	0.7	1.3
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0.9	0	0.6	1.5	0
April	25.4	76.3	0	6.3	45	4.7
May	11	32.8	3.2	5.3	26.8	1.2
Total	2450.2	2696.8	2270.1	2244.6	2120.9	2979.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1908-09

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	557	248.4	604.5	531.5	227.8	670.3
July	1557.5	1360.9	1546.9	1465.8	1057.8	1970.1
August	473.3	477.7	463.1	443.2	401.3	698.9
September	156.8	53.2	191.7	163.1	50.8	175.4
October	25.7	48.4	17.2	23	34.3	76.3
November	0.1	1.5	0	0.5	3	0

December	0	0	0	0	0	0
January	0	1.5	0	1.6	5.4	0.2
February	0	0	0	0	0	0
March	1	6	0	0.7	5.5	0
April	7.3	20.6	0.1	0.2	8.1	0
May	24.3	26.6	12.8	30.8	40.4	20.1
Total	2803	2244.8	2836.3	2660.4	1834.4	3611.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1909-10

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	676.5	360.7	776	620.4	275.3	1038
July	1027.8	1119.8	991.9	976.9	921.5	1490.2
August	199.2	128.9	223.7	195.1	91	383.3
September	211.4	93.9	231.4	189	69.7	349.6
October	17	68	11.8	47.8	118.7	41.7
November	11.6	21.2	2.6	13.7	28.9	5.8
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	2.6	4.7	2.3	2.1	4.1	1
April	0	0	0	0	1.8	0
May	15.4	15.9	21.5	26.1	25.6	7.3
Total	2161.5	1813.1	2261.2	2071.1	1536.6	3316.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1910-11

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	976.8	404.4	1111.4	958.6	344	1098.4
July	444.6	442.7	436.4	392.9	336.5	555.5
August	320.2	527.5	228.1	314.8	481.4	516.1
September	343.2	241.6	370.4	312	171.2	462.1
October	58.9	137.9	27.8	46	118.1	65.9
November	55.8	18.4	69.6	55.5	15.2	81.4

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0.2	2.8	0.2	1.2	3.8	0
May	94.1	47.8	134.4	98	66.2	53.9
Total	2293.8	1823.1	2378.3	2179	1536.4	2833.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1911-12						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	557	407.8	615.3	589.1	375.3	729.4
July	729.4	647.2	722.6	637.8	458.3	901.7
August	415.1	448.4	385.3	381.9	353	488.1
September	101.9	64.8	112	99.7	47.7	173.8
October	51	125.8	24	52.4	119.6	81
November	50.4	19.7	47.6	45.8	12.5	31.2
December	9.3	32.5	0.1	10.6	33.3	3.9
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	41.5	79.6	40.1	45.8	82.9	13.1
May	50.6	67.6	49.4	54.6	69.8	23.5
Total	2006.2	1893.4	1996.4	1917.7	1552.4	2445.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1912-13

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	846.9	319.1	1089.9	846.8	223.8	1263.4
July	1065.3	1235.2	990.3	1061.6	1133.5	1469.3
August	460.8	598.3	418.1	449.3	522.1	609
September	92.7	112.9	85.3	92.1	131.9	129.1
October	70.6	126.2	56.2	69.4	123.6	93.5
November	51.9	39.5	59.8	47.4	31.8	61.7

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0.2	0	0	0.1	0
March	2.6	7.3	0	0	2.9	0
April	5.5	13.1	3.6	4.2	14.2	1.2
May	43.7	57.3	34.1	45.6	83.3	16.3
Total	2640	2509.1	2737.3	2616.4	2267.2	3643.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1913-14						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	743.6	494.5	838.5	750	430.8	907.2
July	890.4	725.1	874.5	837.3	528.9	1110.5
August	289.1	372.7	258.1	284.2	322.1	387
September	159.7	105.9	180.3	153.3	83.8	167.7
October	214.4	119.8	226.1	193.3	93.4	126.6
November	0.5	2.6	0.2	1.3	7.9	8.4
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	11.9	30.8	5.4	8.1	27.6	2.1
May	4.7	11.5	2.8	5.8	8.3	0.6
Total	2314.3	1862.9	2385.9	2233.3	1502.8	2710.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1914-15

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	719.1	312	866.8	691.5	224.4	812
July	1202.2	1574.3	955.8	1104.8	1327.5	1260.9
August	823.9	754.6	889.6	871.8	841.7	1139
September	341.8	243.5	371.7	334.9	188	484.2
October	34.5	29	39.2	33.9	39.2	65.5
November	31.3	64.8	9.4	15	48	14.9

December	18.8	13.9	10	19.9	29.5	23.3
January	0.2	0.6	0	0	4.3	0
February	0	0	0	0	0	0
March	1.9	2.4	2	4.2	6.8	0.4
April	37.7	97.6	10.8	20.7	69.8	14.1
May	29.5	58.9	12.5	17.9	44.3	25.7
Total	3240.9	3151.6	3167.8	3114.6	2823.5	3840

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1915-16						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	827	460.3	928.7	815.6	354.2	1004.7
July	620	463.8	736.9	636.2	428	861.6
August	368.5	282.9	449.1	366.5	237.1	388.6
September	295.2	162.1	310.7	289	167.5	393.1
October	95.9	91.2	92.2	90.3	76.7	120.7
November	18.8	40.7	5.9	17.8	39	9.4
December	1.2	5.5	0	2.2	11.2	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	1	0	0.4	1.9	0
April	15.4	45.9	6.4	16.2	44.4	1.7
May	66.7	54.9	89.8	66.7	74.5	85.7
Total	2308.7	1608.3	2619.7	2300.9	1434.5	2865.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1916-17

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	963.7	607.6	1071.9	901.8	394.6	1343.7
July	687.7	315.1	772.7	682.6	233	825.3
August	445.6	489.5	416	420.1	377.7	824.3
September	639	171.3	813.6	621.4	135.6	727.8
October	140.7	213.3	112.2	116.3	175.2	165
November	139.7	209.7	102.2	119.4	183.6	150.9

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	30.6	25.5	28.7	28.8	19.9	20.2
March	3.8	7.6	2	6.4	11.1	0
April	10.7	35.9	0	4.4	28.3	2.3
May	15.5	1.3	21.1	16.8	1.4	16.1
Total	3077	2076.8	3340.4	2918	1560.4	4075.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1917-18						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	706.9	483.7	726.6	691.9	401.8	1014.6
July	583.4	466.4	553.1	527	324.2	761
August	538.9	278.6	652.2	527.2	224.6	750.3
September	570.9	622.5	498.9	457.3	392.5	512.9
October	285.8	284.7	275.9	253.6	226.5	349.4
November	101.5	90.7	96.6	111.2	78.4	82.8
December	0	0	0	0	0	0
January	0	0.6	0	2	4.9	0
February	0	0	0	0	0	0

March	0.1	2.6	0	0	1.5	0
April	7.3	27.3	1.1	3.3	20.5	0.4
May	634.1	157.5	769	635.9	125.8	664.1
Total	3428.9	2414.6	3573.4	3209.4	1800.7	4135.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1918-19

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	341.6	163.5	382.7	326.6	114.5	472.8
July	366	188.4	390.2	367.2	140	547.4
August	381.9	414.8	359.2	351.7	294.5	621.2
September	159.5	89.1	166.2	162.8	73.7	170.8
October	22.5	67.4	1.5	9.8	36.6	27.1
November	96.3	122.8	84.2	88.6	122.4	149.3

December	0.6	2.8	0	1	2.5	0
January	0	0	0	0	0	0
February	0	0	0	0	0.3	0
March	0	0	0	0.1	0	0
April	2.4	8.4	0	1.5	10.5	0
May	40	97.6	7.6	21.8	85.4	13.7
Total	1410.8	1154.8	1391.6	1331.1	880.4	2002.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1919-20

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	614.2	489.3	605.2	591.5	371.3	728.8
July	813.4	656.4	817.9	728.1	432.2	1074.1
August	488.8	382.5	477.6	471.3	268.5	618
September	162.9	124.5	150.6	169	133.5	193
October	144.2	155.3	145.5	130	117.5	215
November	69.9	130.5	40.9	47.2	94	55.4
December	39.7	8	52.2	45.6	10.1	28
January	2.2	6.7	0	0.4	3.9	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	70.2	89.2	47	61	73.8	18.9
May	21.5	37.7	15.8	27.9	52.6	7.5
Total	2427	2080.1	2352.7	2272	1557.4	2938.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1920-21

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	551	392	555.2	523.5	270.1	556.6
July	785	1051.5	637.5	699.5	765.2	813.3
August	332.8	259	321	309.9	186.1	504.5
September	160.8	93.5	189.4	168	100	172.2
October	57	94.3	41.8	58.9	122.6	109.5
November	1.5	4.9	2.2	6.2	12.8	24.4

December	0	0	0	0	0	0
January	0	0.1	0	0	0	0
February	0	0	0	0	0	0
March	0.2	5.2	0	0	6.3	0
April	30.6	69.7	16.3	18.9	60.8	6.2
May	0	0	0	0.2	0.3	0
Total	1918.9	1970.2	1763.4	1785.1	1524.2	2186.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1921-22						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	617.3	282.8	765.2	652.2	258.6	943.3
July	792.4	777	755.3	723	564.8	817.9
August	438.4	494.9	394.8	403	376.9	689
September	254	167.2	280.8	236.9	109.3	343.9
October	112.1	177	72.8	81	123.2	90.6
November	63.4	121.8	49.8	63.1	126.6	37.9
December	0	0	0	0	0	0
January	0	1.6	0	8.7	7	0
February	0	3.6	0	0	5.1	0

March	0	0	0	0	0	0
April	20.1	41.5	11	15.7	31	12
May	34.2	25.7	28.6	28.1	21.1	34.1
Total	2331.9	2093.1	2358.3	2211.7	1623.6	2968.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1922-23

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	828.9	366.2	999.5	819.2	271.3	947
July	1051.4	1045	1022.6	917.1	682.7	1489.4
August	343.8	383.5	328.5	309.3	258.5	496.5
September	161.5	128.3	160.7	136.3	76	180.9
October	33.3	79.3	12	18.6	60.2	37.9
November	123.6	30.7	189.6	145.8	57.6	266.5

December	0	0	0	0	0	0
January	0	0	0	0.3	0	0
February	0	0	0	0	0.3	0
March	12.1	59.7	0	15.6	63.7	1.5
April	4	21.7	0	5	23.9	2.3
May	26.4	59	19.3	28.4	58.2	32.1
Total	2585	2173.4	2732.2	2395.6	1552.4	3454.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1923-24						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	422.2	227.3	468.3	387.6	134.2	426.8
July	1510.8	1625.9	1408.2	1429.3	1279.1	1774.7
August	610.2	909.3	442.5	505.8	713	641.8
September	269.6	85.8	302.9	271.3	83	353.2
October	6.6	5	15.8	13.8	17	22.7
November	0.5	1	1.1	0.6	0.6	0.4
December	1.6	4.6	0	0.6	1.8	0
January	0	0.3	0	0.3	1.2	0
February	0	0	0	0	0	0

March	5.9	18.7	0	2.1	12.9	0
April	11.9	31	0.2	19.1	41	0
May	0	2	0	1.7	8	0
Total	2839.3	2910.9	2639	2632.2	2291.8	3219.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1924-25

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	752.9	238.3	905.5	742.2	191.1	922.7
July	1160.8	1359.8	1043.4	1103.3	1110.6	1299.5
August	304.2	354.4	283	289	317.1	443.9
September	192.7	218	193.4	155.3	144.5	313.4
October	34.5	73.5	15	18.3	47.3	35.9
November	11.8	21.6	3.4	5.2	15	1.5

December	0	0.4	0	0	0.4	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	1.3	5.8	0.1	1.5	6.7	8.1
April	32.5	26.4	51.1	34.4	36	16.1
May	146.2	90	174.2	142.1	76.3	155.8
Total	2636.9	2388.2	2669.1	2491.3	1945	3196.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1925-26

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	819.9	615.2	816.3	752.9	463.1	936.2
July	711.2	987.5	580.5	660.9	851	871.5
August	495.5	341.5	536.9	455.6	222.3	614
September	71.5	55	87.6	76.4	51.2	122.1
October	74.4	133.3	47.2	73	136.6	128.3
November	18.4	9.9	27.5	17.2	12.4	33.8
December	6.6	20.5	1	5.5	18.2	0
January	6.3	0	10.8	7.9	2	24.1
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	2.1	5.9	2.2	3	16.8	0.6
Total	2205.9	2168.8	2110	2052.4	1773.6	2730.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1926-27

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	498.5	151.4	570.9	496.1	137.4	541.2
July	746.9	894.4	705.9	794.1	845.8	1038.3
August	760.2	978.5	617.4	692.6	745.6	1052.5
September	232.5	143.6	260.9	228.9	127.1	311
October	22.4	36.7	16.4	32.5	48.1	61.5
November	0.2	0	0	0	0	4.1

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0.1	0	0.2
April	11.9	36.4	0.4	3.5	22.7	0.1
May	31.8	42.4	29.4	32.8	52.8	17.5
Total	2304.4	2283.4	2201.3	2280.6	1979.5	3026.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1927-28

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	437.7	344.6	402.2	428.6	325.8	731.1
July	976.4	1264.7	821.5	903.8	1037.9	1149.7
August	301.9	329.2	280.2	278.5	265.7	471.4
September	217.2	163.8	213.8	219.7	183.7	238.7
October	85.6	48.6	90.6	82.5	31.1	158.8
November	89.5	67.7	79.9	75.9	42.8	102.5
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	2.4	20.3	1.7	0.9	6.2	0.3

March	0.7	2.2	0	20	17	0
April	4.5	58.3	3.4	16.2	48.7	0.5
May	5.8	10.2	0.3	24.9	11.1	0
Total	2121.7	2309.6	1893.6	2051	1970	2853

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1928-29

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	663.2	561.5	696.7	530.6	513.4	1000
July	1207.3	1235.3	896	1341.9	1180.1	1266.4
August	1031	798	729.6	1122.5	815.8	935.3
September	473	159.4	100.4	263.5	171	130.5
October	263.3	201.2	398	256.4	213.3	270
November	91	10.2	11.7	31.8	5	4.8

December	8.4	7.1	0	1	9.9	0
January	4.8	5.2	0.5	7.1	7.4	0.7
February	0	2.8	0	0	0.3	0
March	9.7	9.6	1.5	6.3	11	1.1
April	83.4	98.8	19.5	62.7	73.5	3.4
May	50.1	16.6	19.4	58.1	31.6	22.2
Total	3885.2	3105.7	2873.3	3681.9	3032.3	3634.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1929-30

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	973.1	760.9	1348	1214.5	931.7	1282.7
July	1112.3	969.3	762.6	1140.3	933.2	928.5
August	770.6	566.4	503.8	797.8	579.2	568.6
September	360.1	269.9	226.1	235.7	215.2	181.4
October	318.2	217	295.3	174.8	201.4	208.4
November	70.7	65.1	54.7	27.3	35.9	27.5
December	13.7	1.1	1.5	2.2	0	0.3
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0	15	0	0	3	0
May	33.4	76.2	26.4	33.5	69.8	9.5
Total	3652.1	2940.9	3218.4	3626.1	2969.4	3206.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1930-31

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	987.9	755.1	1179.1	1273.2	928.2	1015.8
July	887.7	887.4	476.9	1067.7	866	311.4
August	551.3	475.3	323.5	585.1	443.8	290.6
September	536.1	351.4	428.7	425.4	339.3	256.4
October	340.9	243.4	165.7	241.9	237.4	254
November	66.5	17.5	27.2	52.5	20	13.2

December	4.7	25.4	0.5	5.3	14	2.1
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0.2	0.1	0	0	1.7	0
April	5	51.1	11.1	3.4	28.5	10.3
May	11.7	36.7	6.7	34.2	24.5	5.8
Total	3392	2843.4	2619.4	3688.7	2903.4	2159.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1931-32						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	510.3	272.3	843	527.9	354.4	531.6
July	1667.6	1341.2	1591.1	1955	1454.9	2129.5
August	1701.9	1412.8	715.4	1464.1	1249.1	836.7
September	570.2	279.7	169.7	370.3	243.3	147.6
October	374.3	264.6	284.1	464.3	359.9	355.9
November	174.5	81.1	61.8	111.1	86.2	84.5
December	52	42	37.3	34.4	33.8	29.3
January	13.6	1.4	1.2	2.7	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0.8	47.4	0	2.1	10.7	1.8
May	65.5	82.7	76.4	52.9	83.7	98
Total	5130.7	3825.2	3780	4984.8	3876	4214.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1932-33

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	565.9	349.2	752.7	568.1	396.8	570.8
July	1202.4	1282.5	1034.6	1372.1	1263.1	1373.7
August	881.9	671.2	401.3	792.2	665.4	485
September	542.5	411.1	438.8	623.5	442.8	513
October	279.3	220.3	247.4	336.6	216.7	224.7
November	173.5	141	53.6	114.2	89.2	51.8

December	38.5	2.9	2.8	6.1	1.1	10.7
January	0	0	0	0	0	0
February	0	0	1.7	0	0.2	1.1
March	0	3	0	0	6.2	0
April	48.7	13.2	113.4	18.4	25	39.5
May	162.2	143.2	425.4	288.9	176.7	198.8
Total	3894.9	3237.6	3471.7	4120.1	3283.2	3469.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1933-34

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1027.8	844.8	1024.6	1475.9	1036.3	1119.2
July	1318	1149.7	1040.1	1358.9	1122.5	1155.1
August	717.3	648.8	323	511.3	531.4	515
September	516.8	364.5	219.9	512.4	403.5	235.6
October	245.1	232	158.8	318.9	268.9	332.1
November	131.1	66.1	53.5	95.5	65.7	33.8
December	28.9	30.9	16	23.5	16.9	16.5
January	2.6	0.2	0.2	1.7	0.4	0.5
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	16.9	14.4	0.2	11.4	29.5	0
May	0.7	17.1	4	5.6	9.6	5.1
Total	4005.2	3368.5	2840.3	4315.1	3484.7	3412.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1934-35

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	889.5	782.3	1184	1312.2	954.7	1344.3
July	1286.9	1111.2	599.8	967	1023.2	892.1
August	926.8	943.3	629.3	1049.3	897.2	862.6
September	569.7	312.1	278.7	413.3	309.6	348.7
October	269.1	146.8	71.2	134.9	150.9	41.9
November	53.6	50.1	29	35.6	39.8	24.6

December	15	1.6	1.3	2.9	0	0
January	0	5	0	0	0.5	0
February	2	0.2	0.5	0.4	0	0
March	0	0	0	0	0	0
April	0.7	1.5	0.7	0	2.5	0
May	0	1.2	0	0.5	0.9	0
Total	4013.3	3355.3	2794.5	3916.1	3379.3	3514.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1935-36

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	507.6	323.5	752	615	397.6	824.2
July	1074.8	1012.4	679.1	1120.8	960.2	938
August	669.9	438.6	305.4	440.2	360.9	311.9
September	415.7	342.4	238.1	393.1	303.9	320.4
October	203.4	167.5	73	137.4	129.1	66
November	31.4	15.8	9.3	32.8	17.1	21.8
December	12.2	1.2	1	2.3	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0.9	1.7	0	0	0.8	0
April	4.2	14.8	0	0.8	4.9	0
May	119.6	85.7	107.2	126.5	112.8	45.3
Total	3039.7	2403.6	2165.1	2868.9	2287.3	2527.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1936-37

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1058.6	844.7	916.2	998.5	867.7	1171.6
July	1252.2	939.6	777.6	1241	876.3	924.4
August	546.6	555	320	617.6	512.9	508.8
September	256.5	241.5	161.4	268	222.7	148.8
October	243.4	97.5	125.4	116.1	73.8	140.2
November	115.9	89	91.7	45.4	54	95.7

December	7.9	0	3.4	7.3	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0.3	0	0	0	0
April	129.9	102.4	158.8	94.5	94.3	691.6
May	16.1	1.1	9.3	12.5	0.5	0.3
Total	3627.1	2871.1	2563.8	3400.9	2702.2	3681.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1937-38

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	762.3	571.4	856.2	713.3	564.4	914.5
July	1935.6	1542.3	1208	1633	1363.9	2300.3
August	454.3	311.1	216.5	504.3	311.1	494.6
September	286.5	233	216	291.8	273.9	206
October	275.1	217.5	234.5	353.5	293.2	294.4
November	16.3	0.7	7.1	36.5	7.5	0.3
December	0.9	3.3	0.4	0.8	3.2	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	6.5	66.6	1.5	1	29	7.4
April	3.1	32.4	1.1	8.7	14.7	3.4
May	75	53.1	89.5	49.2	47	56.3
Total	3815.6	3031.4	2830.8	3592.1	2907.9	4277.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1938-39

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1114	1029.9	628.6	1061.3	958.1	1032
July	1345.8	1102.8	612.8	1296.3	1035.7	952.9
August	690.9	526.6	510.9	742.1	541	504.3
September	415.1	304.9	352.3	370	296.6	388.1
October	176.1	149.3	165	263.9	170.8	194
November	34	22	20.4	12.7	9	2.2

December	0.6	0	0.3	0.6	0	0
January	0.6	0	0.3	0.6	0	0
February	0	0	0	0	0	0
March	0	12.7	0	0.3	3.6	0
April	5.8	10.8	2.9	10.2	6.6	3.8
May	0.5	0.2	0.4	0.3	5.7	0.1
Total	3783.4	3159.2	2293.9	3758.3	3027.1	3077.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1939-40

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	906.4	699.3	587.7	930.6	792.3	957.9
July	884.1	829.1	666.3	964.6	834.1	1060.8
August	1012.4	1016.6	583.6	1278.4	1083.7	1139.5
September	286.9	178.9	106.6	193.2	178	140
October	239	213.5	118.8	157.3	157.2	112.7
November	52.3	39.5	24.3	26.1	32	13.2
December	0.2	0	0	0.2	0	0
January	0	0	0	0	0	0
February	0	0	0.1	0	0	8.2

March	0	1.7	0	0	0.2	0
April	2.1	20.7	0.2	18.5	13.2	0.7
May	30.5	70	5.9	53.7	51.4	19.2
Total	3413.9	3069.3	2093.5	3622.6	3142.1	3452.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1940-41

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	631.4	514	641.4	499.5	504.6	717.1
July	1598.1	1255.9	929.4	1415.1	1112.1	1339.8
August	1600.2	1187.2	1123.9	1266.6	978.4	1483.9
September	239.4	118.6	104.6	245.7	118.2	162.5
October	120.5	110.8	110.6	82	101	143.8
November	91.1	46.8	55.2	54.5	39.9	22.3

December	3	0.3	1.2	2.7	0	0
January	15.2	9	19.2	24.2	13.8	23.8
February	0.5	0.4	0.2	2.4	4	0.7
March	0	26.9	0	0	13.9	0
April	3.2	18.8	1.4	2.2	7.8	2.6
May	53.8	71.5	18.4	6.3	31.8	21.5
Total	4356.4	3360.2	3005.5	3601.2	2925.5	3918

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1941-42						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1007.6	750	871	935.4	581.1	804.2
July	519.2	870.5	239.8	596.5	843.4	416.6
August	440	456.9	247.8	550.8	381.4	267.6
September	215	113.5	127.5	183.7	114.3	160.4
October	63.4	109.2	28	160.6	148.3	67.2
November	4.7	1.5	0	0	0.4	0
December	25.4	104.7	16.4	18.7	40.1	23.5
January	0	0	0	0	0	0
February	0	2.7	0	0	0.5	0

March	0	4.6	0	0	0.9	0
April	19.9	20.7	21.4	13.3	12.6	8.1
May	17.7	43.1	0.4	13.2	32.5	1.3
Total	2312.9	2477.4	1552.3	2472.2	2155.5	1748.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1942-43

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1625.3	773.2	1396.1	931.9	603.2	1349.4
July	1594.2	1292	977.9	1508.3	1257.2	1265.1
August	742.8	503.2	659.1	650.4	426.5	554.3
September	248.9	158.8	236.7	246.1	166.3	241.8
October	109.8	98.3	71.3	112.1	55.5	93.1
November	3.2	2.2	7.5	0.1	2.5	1.9

December	3.7	14.9	0	47	22.9	1.9
January	2.9	1.5	22.1	11.1	3.9	1.1
February	0	0	0	0	0	0
March	0	0	0	0	4.6	0
April	0.3	25.7	0.9	0	13.5	0
May	410.6	323.3	398.1	299.7	289.9	363
Total	4741.7	3193.1	3769.7	3806.7	2846	3871.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1943-44

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1017.3	470.9	909.4	839.3	427.3	956.5
July	1166.3	1203.9	840.9	1192.6	1030.2	1047.5
August	289.9	206.4	214.8	334.5	209.2	311
September	452.2	272.1	361.6	391.4	237.7	485.9
October	358	296.1	129.2	115.5	191.1	204.7
November	91.1	123.9	81.6	49.5	72.8	58.8
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0.2	0	0	0	0

March	0	0.2	0.7	0	0	0
April	0.5	20.2	0.4	0	4.3	0.3
May	30.1	22.1	58.9	34.6	37.1	58.7
Total	3405.4	2616	2597.5	2957.4	2209.7	3123.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1944-45

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	879.5	448.1	640.7	787.2	423.8	800.7
July	1332.5	1278.3	893.2	1204.3	1117.4	1373.9
August	528.9	415.6	248.2	380.4	327.1	457.1
September	61.6	49.8	41.4	66.5	117.9	59.1
October	210.8	176.7	134.5	202.8	178	159.7
November	30.5	54.4	9.5	98.4	57.6	20.2

December	0	0	0	0	0	0
January	0	0.4	0.7	1.9	0.8	7.9
February	0	0	0	0	0	0
March	0	0.2	0	0	0	0
April	4.5	6.8	1.9	0.4	11.6	0.1
May	3.3	21.9	0.2	4.9	23.7	1.2
Total	3051.6	2452.2	1970.3	2746.8	2257.9	2879.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1945-46						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	943.8	494	848.7	952.5	529.4	946.1
July	1964.7	1452.2	1292.8	1740.4	1246.6	1543
August	578.7	393.4	386.5	773.4	538.8	507.9
September	537.2	279.1	314.4	375.1	240.6	352.8
October	26.3	35.7	36.7	55.7	40.9	73.3
November	25.1	19.5	24.1	9.7	22.9	4.4
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	14.7	91	14.5	29.3	51.4	39.8
May	38	89.4	99.8	37.6	59.4	64.5
Total	4128.5	2854.3	3017.5	3973.7	2730	3531.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1946-47

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1396.4	861.2	1176	1042.9	694.3	1241.5
July	1100.7	1175.3	497	1177	1079.1	780.2
August	865.6	838.6	512.2	1105.3	809.8	719.7
September	222.6	142.1	175.1	351.9	239.3	172.3
October	95.8	58.1	30.8	42.2	50.1	26.2
November	170.1	124.8	160.6	94.4	120.5	151.1

December	8.1	2.3	9.7	0.3	1.8	6.2
January	0	0	0	0	0	0.8
February	0	0	0	0	0	0
March	3.5	2.9	0.5	0	9.2	2.8
April	33.5	19.5	47.2	24.2	39.9	50.2
May	3.7	6.6	12.1	11.5	17	25
Total	3900	3231.4	2621.2	3849.7	3061	3176

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1947-48

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	758.3	405.8	718.6	810.7	407	788
July	1543.8	1151.8	881.4	1357.6	953.4	1255.9
August	1212.4	766	704.1	1118.1	703.3	832.1
September	470	354.7	213.1	430.9	344.3	259.1
October	76.9	57.8	13.1	85.4	53	14.9
November	1.5	8.1	0	0.2	8.4	8
December	0	1.6	0.2	0	0.3	0.3
January	3	0.8	2.4	2.9	1.1	5.9
February	0	0	0	0	0	0

March	0	14.5	0	0	2.8	0
April	4.6	22.1	4.5	0.3	20.5	5.8
May	5.4	13	12.1	25.6	58.7	16.8
Total	4075.9	2796.2	2549.5	3831.7	2552.8	3186.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1948-49

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	980	561.8	909.6	880.8	547.7	916.1
July	1560.7	924.7	950.2	1229	832.8	1309.5
August	919.1	752.6	650.7	904	645.8	403.4
September	410.9	224	451.6	484.5	273.7	429.2
October	222	196.2	48	161.4	134.3	76.2
November	176	122	98.9	203.3	152.1	74.7

December	0	0	0	0	1	0
January	3.6	0.7	0.6	1.1	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	7.7	46	0.5	11	43	3.9
May	62.6	172.5	206.9	232.6	161	319.6
Total	4342.6	3000.5	3317	4107.7	2791.4	3532.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1949-50

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	142.1	172.5	533.7	790.3	353.7	706.1
July	327.6	714.9	984.2	1778.7	950.4	1267.6
August	612.2	472.4	352.7	810.7	500.5	501.6
September	553.9	327.5	481.2	539.9	300.2	493
October	242.1	256.3	112.2	301.4	212.5	80.7
November	21.5	45.5	38.8	28.1	25.4	48.3
December	0	0.4	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	2.6	0	0	0.5	0
April	1.1	7.8	0.2	7.1	6.1	0
May	151.4	94.5	36.9	35.7	51.3	50.6
Total	2051.9	2094.4	2539.9	4291.9	2400.6	3147.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1950-51

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	798.6	436.5	484.9	700.7	390.7	690.1
July	1880.9	1636.4	1045.7	2076.7	1562.2	1546.5
August	524.5	542.3	308.5	928.1	606.4	469.7
September	1107.2	628.6	578.1	904.9	555.3	855.8
October	151.1	137.9	42.7	191.5	228.7	120.9
November	46.7	64.7	22.8	71.8	49.2	41.2

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	3.5	7.1	25.5	59.6	26.9	6.7
May	99.8	87.8	74.3	162.2	97.2	32.6
Total	4612.3	3541.3	2582.5	5095.5	3516.6	3763.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1951-52

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1429.3	799.6	819.5	960	660.2	636.8
July	1480.9	885.6	1138.2	1017.7	737.9	1030.7
August	537.9	486.1	214	655.5	471.6	362.4
September	219.8	159.9	167.3	296.6	177.2	148.4
October	247.7	171.5	184.9	237.4	196.1	258.5
November	67.9	40.1	71.2	166.8	78.7	19.1
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	8.9	21.8	4.9	0	32	9.5
May	144.9	57.1	78.9	119.5	71.3	48.3
Total	4137.3	2621.7	2678.9	3453.5	2425	2513.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1952-53

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1019.4	587.1	794.6	806.8	509.6	1063.8
July	1201.6	1017.1	597	1469.7	1078.8	1333
August	728.1	652.1	349.9	1231.4	757.4	701.5
September	48.2	32.6	61.9	81.3	52	49.4
October	193.1	140.7	271.6	213.2	204.8	369.2
November	0	0	0	0	0	0

December	14	20.4	3.8	0.6	8.8	5.2
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0.5	0	0	0
April	41.4	94	32.9	31.7	85.2	15.2
May	0	2.1	1.2	0	0.4	0.1
Total	3245.8	2546.1	2113.4	3834.7	2697	3537.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1953-54

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	945.8	780.5	877.5	1243.4	849.6	1076.1
July	1689.3	1263.9	1709.5	1712.6	1214.2	1730.4
August	738.3	858.5	365.6	923.2	813.7	619.2
September	236.3	135.9	140.1	398.6	203.7	161.6
October	418.1	375.2	242.3	379.6	340.6	362.7
November	6.8	2.4	0.5	0	0.7	0
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	22.6	22.8	10.8	0.3	29.5	8.4
April	25.5	59.6	23.9	0.6	27.2	9.4
May	9.2	18.8	6	10.2	38.7	2.4
Total	4091.9	3517.6	3376.2	4668.5	3517.9	3970.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1954-55

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	858.9	507.3	807	925	493.1	1041.3
July	1603.4	1163.2	1494.4	2242.6	1372.9	1627.8
August	806	599.1	579.8	964.9	661.3	962.2
September	529.2	361.9	439.8	702.1	381.1	469.2
October	150.6	150.8	51	223.2	158.7	34.2
November	0	0	0	0	0	0

December	0	0	9.7	0	1.2	4
January	0.6	0.5	2.4	0.2	0	0
February	0	0	0	0	0	0
March	0	3.8	0	20.8	9.7	0
April	20.2	39.4	22.2	57.2	44.8	8.7
May	296	191.8	64.9	146	162.6	37.2
Total	4264.9	3017.8	3471.2	5282	3285.4	4184.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1955-56						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	959.8	507.5	989.8	788	550.7	980
July	964	501.4	1050.6	1012.5	571.1	1158.3
August	1060.3	749.3	722.9	1146.1	649.9	943.5
September	396.2	337.5	291.4	554.2	374.4	458.9
October	493.7	328.9	303.4	712.9	454.3	411.2
November	69.4	24.8	7.9	17.7	14.3	2.3
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	1.7	10.6	2	0.2	6	0.4

March	0	0	0	0	0	0
April	29.5	35.5	25	10.2	28.3	8.9
May	351.8	200.2	352.6	250.8	147	321.4
Total	4326.4	2695.7	3745.6	4492.6	2796	4284.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1956-57

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1124.6	768.9	1113.8	1063.7	718.2	1028.2
July	1644.2	1351.1	1155.7	1856.1	1270.3	1424.2
August	491.3	528.8	347.8	902.8	595	562.4
September	333	195.3	336	349	202.1	311.9
October	244	213.3	122.2	325.4	297.4	147.8
November	197.4	114.3	37.6	70.2	74.2	56.7

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	1.8	0	0	2.6	0
April	12.3	17.8	0.3	0.3	11.7	0.4
May	54.4	104.2	13	36.3	78	17.7
Total	4101.2	3295.5	3126.4	4603.8	3249.5	3549.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1957-58

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	616.1	391.7	646.1	777.7	495.4	830.8
July	1284.4	1049.7	985.3	1697.8	1053.5	1233.7
August	869.1	699.9	633.3	1293.9	823.1	1027
September	156.2	94.9	133.3	245.7	134.8	218.1
October	167.2	175	133.2	252.6	269.2	166.6
November	102	90.8	78.3	130.6	101.5	65
December	0	0	0	0	0	0
January	0	0.7	0.5	0	0.1	0
February	0	0	0	0	0	0

March	0	1.1	0	1.9	7.4	0
April	3.1	28.6	11.1	12.1	22.5	7.9
May	156.5	213.5	138.7	221	174.9	79.7
Total	3354.6	2745.9	2759.8	4633.3	3082.4	3628.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1958-59

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1139.6	721.4	1022	1237.4	719	1097
July	1304	1597.4	815	1689.6	1557.5	1136.1
August	926.3	618	1171.5	1179.2	623	1282.8
September	327.7	173.1	261.2	364.5	192.2	292.6
October	123.8	114.4	105	167.6	133.5	115.3
November	55.8	31.8	16.9	126.6	63.6	26.5

December	0	0.9	0	0	0.2	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	8.4	33.7	1.1	7.5	37	5.9
May	109.3	162.9	70.9	119.7	96.3	103.1
Total	3994.9	3453.6	3463.6	4892.1	3422.3	4059.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1959-60

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1211.7	651.6	1263.2	1480.4	890.6	1216.3
July	1593.8	1694.6	1139.2	2209.1	1705	1370.2
August	895.6	687.1	478	1022.2	667.4	599.8
September	512	371.3	279.8	686.7	401.3	304.6
October	59.5	48.2	46.1	85.6	54.9	52.5
November	79.7	51.9	24.4	29.3	30.7	51.3
December	0.4	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	5.4	0	0	1.1	0
April	0.1	9.5	0	9.7	5	0.9
May	169.3	162.9	210.4	247.1	158.4	212.9
Total	4522.1	3682.5	3441.1	5770.1	3914.4	3808.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1960-61

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	936.4	574.7	815.5	1086	631.8	1037.2
July	1430.6	1003.2	840.7	1325.6	889.2	1105.7
August	661.2	558.4	413.8	874.2	555.8	583.4
September	311	243.2	373.7	378.1	248.2	354
October	119.2	86.4	55.9	171.1	92.2	64.9
November	36.4	36.7	38.1	21.1	20.8	45.3

December	0	0	0	0	3.6	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0.7	0	0	0	0
April	20.1	21.4	15.5	2.5	11.4	4.9
May	651.2	479.4	722.3	617.4	433.6	354.7
Total	4166.1	3004.1	3275.5	4476	2886.6	3550.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1961-62						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1137.6	426.2	1072.9	983.4	457.1	1141.6
July	1613.3	1630.4	1333.9	2166.1	1806.9	1416.9
August	731.3	703.6	609.4	1353	805.9	773.1
September	639.1	348.2	486.5	824	427.2	699.8
October	156.4	122.1	135.8	153.5	143.9	111.9
November	3.2	43	10.3	4.9	12.8	14.6
December	0	0	0	0	0	0
January	50.2	13.1	173.5	65.6	21.2	48
February	105.2	89.2	115.4	68	43	28.5

March	28.2	20.2	57.2	95.6	32.1	18.4
April	38.3	104.5	32.9	22.7	62.3	17.2
May	25	235.8	112.4	16.6	84.2	38.2
Total	4527.8	3736.3	4140.2	5753.4	3896.6	4308.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1962-63

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	76.1	40.3	7.2	173.8	120.8	29.7
July	230.3	496.9	518.5	53.3	128.7	464.2
August	355	1292.5	1033.3	83.5	418.8	476.6
September	156.6	289.4	414.6	321.6	164	334.6
October	32.8	298.4	148	6.5	134.6	127.5
November	30.7	25.3	12.3	12.8	11.8	27.3

December	109.9	59	204.1	90.5	55.3	222.8
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	4.6	1.2	0	3.1	0.3
April	1.9	36.9	0.5	14.1	23.4	0.1
May	7.6	55	105.1	44.2	56.7	36.8
Total	1000.9	2598.3	2444.8	800.3	1117.2	1719.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1963-64

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	650	321.1	850	890.6	415.7	1020.2
July	834.6	732.2	704	897.8	747.9	926.3
August	1206.4	950.4	1112.6	1457.2	945.2	1360.5
September	157.3	133.3	140.7	232.9	125.5	300.8
October	111.5	178	168.4	335.5	199.2	261.7
November	6.6	5.8	13	3.6	2.6	21.8
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	16.6	0	0	6.8	0
April	0	0.8	0	0	0.6	0
May	1	0	1.3	4.1	1.4	0
Total	2967.4	2338.2	2990	3821.7	2444.9	3891.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1964-65

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	630.1	495.9	768.7	832.2	378.9	1050.6
July	565.9	802.3	883.8	1064.3	541.6	1360
August	1018.9	1050.6	745.6	1195.9	868.2	1140.8
September	473.8	335.2	268.4	410.3	379.7	288.6
October	199	170.2	223.7	352.3	177.9	229.4
November	29.2	43.3	18.5	68.5	56.3	23.4

December	2.7	1.3	2	0.2	0.7	0.8
January	0	0.7	2.1	0	0.6	0.9
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	11	14.9	0	22.8	10.7
May	0	8.6	0	0	8.2	0
Total	2919.6	2919.1	2927.7	3923.7	2434.9	4105.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1965-66						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1141.7	552	981.1	872.4	275.3	1002.9
July	1227	1376.3	966.9	1633	1018	1062.8
August	673.9	387.2	411.3	532.1	198.7	397
September	265.4	202.8	252	305.4	132.4	156
October	14	53.7	3	33.9	25.8	4.3
November	2	3.2	1.4	17.7	3.6	3.4
December	202.4	70	270.4	152.5	52.1	262.6
January	0	0	0	0	0	0
February	0	0	0.6	0	0	0

March	0	0	0	0	0	0
April	3.3	18.6	1.1	0.3	14.1	0
May	396	288.6	266.3	481.4	413.6	86.9
Total	3925.7	2952.4	3154.1	4028.7	2133.6	2975.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1966-67

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	444.6	324.5	551.4	518.4	207.4	406.3
July	1124.4	1457.3	1001.5	1657.2	1006.3	1223.7
August	314.3	269.5	150.2	295.3	223.5	236.1
September	454.3	415.2	328.1	588.5	403.8	394.7
October	221.1	145	67.1	91.6	96.1	58.6
November	103.6	216.1	205.3	330	266.2	211.1

December	1.6	20.6	3.7	31.8	14.8	0.3
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	10.3	0
April	1.3	4.6	1.2	2.4	0.7	1.7
May	14.7	4.2	31	1.4	2.1	28
Total	2679.9	2857	2339.5	3516.6	2231.2	2560.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1967-68

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	668.6	289.8	827.7	818.8	225	859.9
July	1138.2	863.5	1112.9	1576.5	597	1139.1
August	414.7	477.4	322.5	733.9	306.9	343.2
September	297.5	129.3	275.3	556.9	137.7	294
October	114.9	67	119	225.4	72	93.2
November	1.1	0.3	6.1	3.5	1	5.1
December	0.3	12.2	0.2	0	9.1	1.6
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	83	103.2	45	26.7	31.4	0.4
May	8.8	11.3	11.7	48.8	19.5	4.7
Total	2727.1	1954	2720.4	3990.5	1399.6	2741.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1968-69

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1127.2	521.9	709.7	854.5	259.2	969.9
July	1818.9	1201.4	1263.2	1876.7	841.9	1385
August	309.9	469.3	161.1	452.6	564.5	203.9
September	287.6	194.7	77.7	212.2	102.8	149.8
October	331.4	201	275.1	362.8	131.4	212.1
November	6.5	21.4	11.5	24.6	39.6	4.8

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0.6	0.9	5.6	31.9	27.1	17
May	33.7	14.4	6	27.1	39.3	12.3
Total	3915.8	2625	2509.9	3842.4	2005.8	2954.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1969-70

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	801.8	378.7	883.5	681.4	229.4	873.5
July	2002.8	1297	864	1633.4	1123.5	1220
August	688.8	709.2	217.4	836.6	587.1	405.5
September	728.3	338.8	537.1	474.9	163.6	582.1
October	174.4	113.1	50.4	104.3	73	107.8
November	72.2	32.2	50.4	28.8	43	15.5
December	12.5	9.9	0.4	2.3	5.5	2.5
January	0	0	0	0.1	0.4	0
February	0.3	0	0	0.2	0.8	0

March	0.3	0	0	0.8	2.4	0
April	6.1	30.4	2.6	44.6	34.4	0
May	240.2	171.1	209.9	193.4	99	231.4
Total	4727.7	3080.4	2815.7	4000.8	2362.1	3438.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1970-71

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1959.7	566.9	828.5	974.4	223.9	1028.9
July	1909.8	1317.4	894.1	1763.2	959.5	1209.7
August	1628	1071.7	1080	1265.5	750.4	1219.7
September	325.2	213.9	238.6	282.9	161.4	278.2
October	51.3	149.1	40	143.5	129.4	141.4
November	26.9	15.4	0.3	13.1	7.3	0

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	1.8	11.1	2.2	3.3	7.6	4.1
May	154.9	25	149.3	171.5	45.1	70.4
Total	6057.6	3370.5	3233	4617.4	2284.6	3952.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1971-72

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	712.2	560.6	1116.1	696.2	573.3	1079.4
July	675.1	524.7	733.8	603.5	547.6	709.4
August	386.3	290.6	310.6	332.1	309.5	365.5
September	120.4	245.7	225.2	332.1	166.6	310.7
October	21.7	18.8	11.3	51.6	25.1	39.4
November	4	3.7	9.7	33.6	15.7	0
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0.2	0	0

March	0	0	0	0	0	0
April	0.9	1.2	3.3	3.6	11.9	1.1
May	35.3	9.3	50.4	59.2	38.8	18.3
Total	1955.9	1654.6	2460.4	2112.1	1688.5	2523.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1972-73

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	544.1	626.2	771.4	422.1	345.1	805.1
July	874.2	1116.8	546.7	858.2	827.5	938.7
August	394.5	349.6	313	353	241.8	487
September	128.7	166.1	78.2	199.1	167.3	160.5
October	54.4	116.6	18.4	44.6	69.7	31.8
November	1.1	1.2	2.1	2.9	10.9	19.9

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	0	0	0	8.3	0
May	13	37.3	22.4	37.7	53.4	21.1
Total	2010	2413.8	1752.2	1917.6	1724	2464.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1973-74

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	820.2	753.7	830.3	933	469.9	687
July	849.6	1171.7	879.6	1144.5	826.9	948.2
August	1219.2	1043.8	864.5	1059.2	563.2	931.2
September	228.3	278.6	121.3	216.1	89	130.7
October	121	90.9	186.6	250.5	132.9	151.4
November	6.9	6.9	16.2	34.1	14.4	2.7
December	0	0	4.4	0	0	5.8
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	1	0
April	8.4	17.9	2.9	9.1	20.3	4.5
May	123.3	133.8	135.8	126.4	142.7	123.7
Total	3376.9	3497.3	3041.6	3772.9	2260.3	2985.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1974-75

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	420.4	429.2	836.6	394.9	187.5	727
July	1757	1397.8	1130.5	1561.1	795.7	1350.2
August	1259.6	980.5	527.6	1099.8	578.1	702
September	320.2	349.2	374.1	510.5	183.5	424.6
October	530.9	216.4	322.4	272.4	129.7	123.2
November	0	0	0	0	0	0

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0.2	0	0	0
April	13.7	16.9	5	10.4	17.7	0
May	16.2	53.7	19	36.3	33.6	7.1
Total	4318	3443.7	3215.4	3885.4	1925.8	3334.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1975-76

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1267.4	859.3	757.3	1202	822.7	1046.5
July	1248.4	841	969.5	1447.5	779.6	1168.1
August	1046.3	732.4	632.8	891.7	672.2	715.8
September	934.1	462.8	514.4	858.3	382.2	538.9
October	132.4	130.2	234.3	306.9	145.6	319.6
November	65.7	58.4	19.1	120.4	54	9.9
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	2.2	0	8.8	4	10.9	7.7
April	0.7	3.6	0.5	0.6	23.6	7.7
May	3.5	0	4.4	4.5	0	2.9
Total	4700.7	3087.7	3141.1	4835.9	2890.8	3817.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1976-77

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	367.8	207.6	692.4	498.6	383.1	571.2
July	990.8	933.9	1058.7	1045.7	851.9	916.2
August	573.5	612.4	521.2	262	387.5	521.1
September	261.1	247.2	259.6	213.6	191.2	193.6
October	22.4	36.7	19.2	31.1	96.2	54
November	74.8	11.6	136.8	123.7	44	101.9

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0.9	0	0	4.5	0
March	7.5	0.8	2.1	21.9	9.2	0.6
April	0	4.1	0.4	58.9	42.8	0.6
May	34.6	8.4	57.5	59.7	51.8	20.6
Total	2332.5	2063.6	2747.9	2315.2	2062.2	2379.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1977-78						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	526.5	375.7	776	933.3	383.8	931.8
July	1270.8	901.4	1254.1	1776	992.3	1721.6
August	441.1	376.7	379	797.2	481.8	579.7
September	328.3	332.4	260.8	465.5	249.5	342.9
October	76.4	68.6	86.2	96.7	69.8	95.6
November	93.1	124.3	98.1	46.1	95.8	99.9
December	0.6	0	0.8	0.6	0	0.3
January	0	0	0	0	0	0
February	0	0	0	0	1.3	0

March	0	0	0	0	0	0
April	11.1	4.4	20.3	20.9	21	14.8
May	108.2	7.5	206.2	179.4	46.2	155.9
Total	2856.1	2191	3081.5	4315.7	2341.5	3942.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1978-79

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	937.1	824.6	1088.2	1722.8	933.6	1115.6
July	691.1	1246	947.8	1591.6	901.1	1057.7
August	721.2	1020.9	385.8	1503.8	939.1	553
September	150.5	108.8	192.3	118.5	123.9	334.2
October	45	49.4	51.1	385.7	83.8	67.5
November	14.1	23.8	19.7	37.3	62.4	17.8

December	0	0.1	0	0	0.4	0.7
January	0	0	0	2.2	17.1	0
February	0	0	0	0.2	1.5	0
March	0	0	0.3	0.1	0	0.1
April	0	0	0	0	0.6	0
May	0	0	0	0	38.4	1.8
Total	2559	3273.6	2685.2	5362.2	3101.9	3148.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1979-80

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	484.7	628.1	725.9	875.8	537	671
July	1339.8	828.4	701.8	1188.2	726.1	881.1
August	783	1251.4	466.1	1075	1326.1	534.8
September	183.2	350.9	201.1	342.1	355.4	255.7
October	93.3	80	58.2	118.8	77.2	100.8
November	51.2	15.7	94.7	196.4	160.5	78.3
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	8.5	10.2	21.3	21.5	63.2	22.5
May	9.1	5.7	21.4	20.2	30.8	16.9
Total	2952.8	3170.4	2290.5	3838	3276.3	2561.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1980-81

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1054.3	995.7	1021.2	1761.3	1032.3	1091.2
July	920.6	1220.7	574.5	2293.4	1330.2	799.5
August	963.2	934.2	794	1950.7	1097	795.5
September	155.8	195.5	99.9	370.6	193.8	146.5
October	28.1	25.8	3.7	84	12	42.4
November	45.6	9.7	72.1	71.6	54.5	36.8

December	14.4	0.8	26.4	20.1	11.1	33.7
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0.2	0	0.3	2.7	3.2	0
May	51.2	8.9	13.9	40.9	78.7	8
Total	3233.4	3391.3	2606	6595.3	3812.8	2953.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1981-82						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1565.8	290.1	1260.5	1239.4	758.8	1367.5
July	1349.1	1122.2	1002.1	1391.4	1589.8	1339.5
August	1149.6	1939.1	747.8	1221.9	1606	846.4
September	354.9	618.6	274.8	588.5	433	481
October	102.3	280.9	33.9	62.7	70.5	70.7
November	37.8	9	3.8	115.2	26.1	4.7
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0	0	0	0	0.8	0
May	83.2	10.1	38.9	169.5	49.2	24.6
Total	4642.7	4270	3361.8	4788.6	4534.2	4134.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1982-83

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	982.5	1008.5	1005.7	970.6	559.4	1031.3
July	1369.6	1976.6	988.6	1565.5	1701.6	1127.3
August	1451.3	2160	869.5	1799.7	1615.2	1181.4
September	232.4	231.8	157.5	228.2	165.6	213.9
October	78.7	188	31.8	65	56.6	80
November	72.1	35	39.7	66.6	10	39.4

December	0	15.5	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	0	0	6.8	9.1	20.9	0
Total	4186.6	5615.4	3099.6	4704.7	4129.3	3673.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1983-84

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	737.2	900.9	648.1	1132	1008.4	757.7
July	1204.4	1129.6	1024.3	1424.1	1234.6	1363.7
August	1623.3	1365.8	1168	1418.9	1016.6	1340.9
September	679.9	518.7	744.7	737.4	455.6	795.1
October	87.5	136.5	109.8	91.6	104.2	64.4
November	40.7	1.4	11.5	17	7.6	49.8
December	32.5	0	14.9	19.3	0.6	2
January	0	0	0.2	0	0	0
February	0	0	2.1	0	0	0.2

March	0	0	0.1	0	1.1	1.7
April	1.5	0	4.9	4.4	0.8	6.9
May	0	0	3.1	1.6	1.7	9.1
Total	4407	4052.9	3731.7	4846.3	3831.2	4391.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1984-85

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	962.6	997.1	976.1	1109	849.4	949
July	1340.6	1769.6	798.6	1514.7	1516.7	1062.3
August	643.6	939.3	405.7	655.1	740.6	496.5
September	264.8	318	201.9	310.4	225.5	334.3
October	135.5	135.6	154.1	279.8	144.9	285.2
November	64.9	0	8.8	0.2	0	3.3

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0.2	0	0.2	0.1
April	0	0	7.6	0.2	8.5	0.7
May	98.1	0	33.1	7.2	15.9	25.8
Total	3510.1	4159.6	2586.1	3876.6	3501.7	3157.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1985-86

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1560.8	1289.2	1333.5	1375.9	806.6	1322.2
July	1094.3	1104.9	550.2	860.5	832.3	924.8
August	674.3	1771	590.4	880.5	888.8	755.3
September	101.4	89.1	94.2	159.4	138	73.5
October	464.9	264.2	345.3	354.4	269.7	458.6
November	0.3	0	4.6	7.7	0	0.4
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0	0	0.9	0	0	3.3
May	3.1	0	0.4	2	0	9
Total	3899.1	4518.4	2919.5	3640.4	2935.4	3547.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1986-87

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	837.2	751.4	656.9	983.2	1042.2	693.5
July	815.4	799.9	467.6	814.1	1003.3	621.8
August	926.9	1290.3	534.6	938.4	1118.3	446.8
September	118.7	115	27.7	177.4	85.4	47.4
October	6.3	150.8	20.5	37.8	22.4	8
November	71.1	0	90.2	126.5	6	114.8

December	0	0	0	0	0	0.1
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	5.1	0	0	0	3.9	0
May	14.7	0	8.4	73.3	32.7	5
Total	2795.4	3107.4	1805.9	3150.7	3314.2	1937.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1987-88

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	775.5	670.5	1120.7	957.9	593.3	1229.9
July	876.8	1163.2	626.8	996.5	1089.9	556.1
August	771.3	1084.1	637.6	924.2	772.3	726.8
September	154.4	196.1	154.8	322.5	234.1	109.7
October	277.6	178.9	187.6	309.8	177.7	219.3
November	14.6	12.6	19.7	27.8	29.9	29.1
December	3.5	0	4.7	1.5	0	1.8
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	6.4	4.6	10.5	0	0	7
May	20.3	9	0.9	8.7	0	9.8
Total	2900.4	3319	2763.3	3548.9	2897.2	2889.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1988-89

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	516.8	318.2	591	734.4	661.6	599
July	1624	1242.6	1173.8	2437	2096.5	1081.8
August	1035.5	1038.8	821.3	1493	1086.8	656.9
September	485.5	305.8	393.9	810.4	643.2	605.5
October	78.9	7.5	52.6	44.4	70.7	35.7
November	0	0	0	0	0	0

December	0	1.1	0	4.6	5.6	6.7
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	4.4	1.7	8.3	3.5	3.2
April	0.5	22.6	1.9	1.7	5.7	0.7
May	6.9	37.5	17.8	33.5	42.8	22.9
Total	3748.1	2978.5	3054	5567.3	4616.4	3012.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1989-90

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1172	1113.7	707	1373.4	1211.1	860.9
July	902.8	1129.6	741	1118.9	1316.8	777.9
August	797.5	807.2	674.2	845.4	816.4	470.5
September	264.9	193.5	312.2	419.9	225.1	320.4
October	60.8	19.7	83.3	74.6	31.9	91.2
November	30.8	12.1	0.1	0.7	15.4	2.1
December	0	7.4	0.1	0	0.6	0
January	0	0	0.1	0	0	0.2
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0.1	0.3	0	0.1	2.7	1.4
May	282.3	116.9	399.9	273.1	184.5	333.6
Total	3511.2	3400.4	2917.9	4106.1	3804.5	2858.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1990-91

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1072.7	730.5	768.1	1135.9	1093.6	908.8
July	900.3	1083.4	587.5	1427.8	1775.1	850.7
August	975.8	1560.8	679	1224.9	1407.6	770.1
September	376.8	352.9	227.7	502.6	446.1	267.1
October	284.8	130.2	85.2	219.8	192.3	94.6
November	29.2	27.7	38.1	71.8	33.4	25

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	33.2	59.7	16.9	38.2	56.3	19.7
May	78	59.1	31.6	52.8	66.1	37.1
Total	3750.8	4004.3	2434.1	4673.8	5070.5	2973.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1991-92

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	672.4	963.5	490.2	837.4	978.5	620.7
July	1611	1594.6	1134.1	1627.2	1986.6	1316.4
August	831.5	1400.8	433.5	986.6	1216.7	520.1
September	81.9	204.3	52.4	131.3	81.4	34.3
October	63.4	16.4	12.7	68.4	45.3	23.9
November	3.2	19.7	8.4	6.9	6.5	2.4
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	2.4	19.4	0	2.6	4	0
May	24.9	39.3	16.4	35.7	46	44.3
Total	3290.7	4258	2147.7	3696.1	4365	2562.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1992-93

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1115.4	934.1	1002.2	1133.8	699.3	993.9
July	1135.1	1404.1	736	1304.5	1452.1	829.6
August	1163.1	1348.9	711	1194.8	1444.7	814
September	251.7	310.5	165.2	329.3	405.2	212.6
October	97.5	110.2	66.5	201.9	164.9	108.6
November	24.1	41.4	2.5	21.4	19.4	22

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0.1
April	0.5	10.5	0	0	11.8	0.3
May	56.7	33.5	59.3	11.3	49.6	77.2
Total	3844.1	4193.2	2742.7	4197	4247	3058.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1993-94

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	596.5	781.9	473.2	1014.7	770.8	537.8
July	1448.9	1509.3	1215.7	1822.9	1822.1	1162.8
August	646.4	931.7	346.9	960.5	1146.4	511.2
September	251.8	241.2	212.2	409.8	301.8	308.1
October	301.3	206.4	191.3	306.8	127.2	291.6
November	15.9	20.9	4	26.5	35	12.2
December	24.1	38.8	11.5	23.5	24.9	14.9
January	0	3.7	0	0	0	0
February	0	0	0	0	0	0

March	0.3	3.4	0	0	3.9	0
April	9.9	30.5	15.9	19.7	72	5.7
May	18.2	7.8	35.5	23.1	6.3	7.2
Total	3313.3	3775.6	2506.2	4607.5	4310.4	2851.5

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1994-95

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1028.9	1367.5	836.5	1423.3	1442.1	975
July	1448.2	2482.3	935.3	2284.5	2524.8	1060.9
August	950.1	1601	614.4	1422.9	1440.3	606.4
September	266.9	578.4	212.5	505.6	591.7	249.7
October	274	280.7	265.2	195.1	202.3	312.7
November	0	1.3	1.8	0.5	0	1.2

December	0	1.5	0	0	0	0
January	11.9	3.6	12.9	12.6	6.2	3.8
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	15.8	18.8	2	29.9	2.7	0.6
May	72.3	19.6	40.2	102.4	60	22.4
Total	4068.1	6354.7	2920.8	5976.8	6270.1	3232.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1995-96

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	649.8	493.9	779.2	557.6	344.4	644.6
July	1509.9	1480.2	1457.7	1708.9	1505	1435.1
August	761.4	742.2	767.3	796.2	774.9	878.9
September	220.5	351.2	210.5	370.9	466.9	309.6
October	368.1	156.8	253.3	208.2	224.7	276.2
November	45.8	4.7	6.4	23.3	12.6	10.8
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0.1	0	0	0	0

March	0	0	0	0	0	0
April	4.3	1.1	0.4	3.4	5.8	0
May	14	11.8	0.5	2.7	6.2	2.7
Total	3573.8	3242	3475.3	3671.2	3340.5	3557.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1996-97

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	944.2	1012.2	1109.9	1014.2	783.7	1164.3
July	1218.7	1542.3	1199	1308.5	1439.5	1252.7
August	524.3	903.1	358.1	663	705.7	447.9
September	312.2	280.1	191.6	378.6	331.7	203.1
October	264.5	359.3	223.8	419	414.5	313
November	0	2.5	8.7	16.7	0	5

December	13.5	24.3	4.6	7	0	1.4
January	0.7	0	7.7	4.2	0.7	4.9
February	0	0	0	0	0	0
March	9.5	10.8	0	9.5	25.6	0
April	8.7	0	0	5.8	21.9	0
May	0	0	0	15	2.5	0
Total	3296.3	4134.6	3103.4	3841.5	3725.8	3392.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1997-98

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1013	894.6	1090.3	1358.1	1166.9	1104.6
July	1461.8	1563.6	1176.7	1505.9	1686.6	1166.3
August	1207.5	1547.1	900.3	1710.9	2020	1080.2
September	50.1	168.2	67.1	81.9	169	104.7
October	93.8	163.9	46.4	105.9	54.2	24.4
November	70.6	195	68.3	143.6	22.3	83.5
December	53	59.8	68	73.2	32.9	88.5
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	6.6	30	0	0.4	1.1	0
May	85.7	62.7	66.3	46.7	51.7	13.5
Total	4042.1	4684.9	3483.4	5026.6	5204.7	3665.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1998-99

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	949.3	904.6	1024.8	989.3	728.2	1018.4
July	1700.2	1159.7	773.6	1669.9	1163.4	1066.7
August	1048.9	911.7	516.3	1052.6	716.4	603.1
September	490.9	587.8	436.1	588.3	334	406.4
October	351.5	317.1	172.2	372.5	187.6	317.4
November	69	38.9	44.7	79.4	46.5	69.4

December	0	0	0.5	0	0.3	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0.6
March	0	0	0	0	0	0
April	0	0	0	0	0	0
May	257	188.1	317.1	226.1	65.2	99.7
Total	4866.8	4107.9	3285.3	4978.1	3241.6	3581.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 1999-2000

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1383.2	966.2	1595.8	1325.1	937.2	1581.1
July	1654	1771.1	1195.3	2070.5	2314.4	1328.3
August	401.2	593.4	202.1	512.2	678.8	262.6
September	282.1	180.3	200.6	333.6	340.2	204.9
October	298	210	175	257	188.4	151.4
November	3.9	0	3.1	22.8	0.4	3.9
December	0	0	0	0	0	0
January	0	0	0	0	0	0.4
February	0	0	0	0	0	0

March	0	0	0	0.2	0.4	0
April	9.4	15.9	10.1	9.6	28.9	11
May	213.6	117.7	291.2	241.6	119.2	212.1
Total	4245.4	3854.6	3673.2	4772.6	4607.9	3755.7

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2000-01

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1401.3	881.6	1115.1	1291.6	722.8	1119.8
July	1582.3	1269.7	1338.1	1412.3	1514	1241.2
August	805.6	928.3	532	950.9	965.1	690.2
September	240.7	348.8	103.7	248.3	329.9	129.5
October	207.4	159.5	69.8	101.9	100.2	104
November	8.4	0	2.6	4.9	1.3	0.2

December	0	0	0.3	0	0	0
January	1.7	0	8.9	2.3	0	0.6
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	13.4	13.2	6	19.2	46.6	2
May	163.6	54.5	171.1	84.2	82.9	97.9
Total	4424.4	3655.6	3347.6	4115.6	3762.8	3385.4

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2001-02						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	963.5	811.2	518.5	781.4	717	564.2
July	1133.3	959.5	839.2	1168.3	1251.3	1070.3
August	655.9	804.8	393.4	850.4	1113	486.5
September	98.7	84.6	101.7	164.4	155.8	154.5
October	140.6	48.3	83.4	163.3	48.9	173.4
November	6.1	0	11.4	29.6	8	7.9
December	0	1.6	0	1.1	9.7	0
January	0	0	0	0	1.1	0
February	0	0	0	0.2	0	0

March	0	0	0	0	0	0
April	12.5	16.3	1	9.1	14.7	0
May	71.5	44.7	53.3	24.4	23.2	12.5
Total	3082.1	2771	2001.9	3192.2	3342.7	2469.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2002-03

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1039.5	761.5	1095.7	1064	820.4	998.9
July	702.7	752.6	306	712.6	815.8	452.9
August	677.6	941.1	569	1043.1	1228.9	822.4
September	148.4	180.2	125	203.8	181.2	162
October	216.8	139	90.6	379.7	136.6	145.4
November	0	0	0	0	0	0

December	0	0	0	0	0	0
January	0.4	0.4	0.7	0	2.5	0
February	0	0	0	0	0	0
March	1	3	0.6	22.3	8.7	0
April	1.5	32.2	1.9	23.4	28.6	1
May	0.5	1.5	0	0	2.5	0
Total	2788.4	2811.5	2189.5	3448.9	3225.2	2582.6

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2003-04

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1053.9	1016.1	895	1153.9	1303.3	934.6
July	983.3	936.2	1093.2	1312.8	1388.1	1165.1
August	689.4	721.1	410.2	797.7	939.1	659.1
September	340.7	246.7	191.9	226	420.2	229.3
October	143.8	118.2	51.2	116.4	122.2	82.8
November	16.4	4.2	7.6	10	4.7	1.4
December	0	0	0	0	0	0
January	0	0	0	0	0.3	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	0.6	2.1	0	0	7.5	1.8
May	126.8	167.6	155.6	27.7	173.8	101.9
Total	3354.9	3212.2	2804.7	3644.5	4359.2	3176

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2004-05

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	736.1	917.2	623.1	808	1129.7	855.8
July	882.6	979.6	626.4	975.9	1475.9	788.7
August	853.9	1465	474.9	870.7	1961.9	660.9
September	195.2	119.2	138.9	293.5	187.6	159.9
October	70.2	49.6	79.2	57.8	59.3	51.6
November	24.4	2	23.2	2.2	8.6	34.2

December	0	0	0	0	0	0
January	0	0	0.9	0	0	2
February	0	0	1.3	0	0	1.4
March	0	0	0	0	0	0
April	1.7	4.4	32.9	25.8	16.1	19.8
May	39.3	33.1	43.4	19.7	26.6	41.9
Total	2803.4	3570.1	2044.2	3053.6	4865.7	2616.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2005-06						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	852.1	919.4	827.5	1072	950	830.4
July	1232.5	1314.9	1134	1677.5	1509	1113
August	532.5	588	407.7	687.2	628.2	379.6
September	539.2	583.8	612.2	858.5	729.1	581.7
October	221	229.9	121.8	205.4	213	131.6
November	0.9	1.4	0	0	0.5	0
December	0	0	0.1	0	0	1
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	7.9	0	26.1	32	7.2	4.6
April	0	0	0.5	3.3	3.2	8.5
May	168.7	243.2	641.1	215.8	192.5	267.4
Total	3554.8	3880.6	3771	4751.7	4232.7	3317.8

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2006-07

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1018	575	712.2	1251.8	831.2	670.1
July	2061.8	1474.1	369.7	2704.7	2212.9	827.7
August	1954.7	1194.1	582.8	1973.9	1610.4	632.1
September	654.9	389.7	396.3	535.4	399.6	561.5
October	156.7	210.9	436.1	190.5	188.6	222.9
November	0	0	29.8	73.4	10.4	13.5

December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	27	49.1	0.2	5.8	39	0
May	44.4	14.1	93.2	65.6	8.3	66.4
Total	5917.5	3907	2620.3	6801.1	5300.4	2994.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2007-08						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	928.4	774.7	1070.2	1118.9	824.4	946.6
July	920.8	1111.6	697.9	1139.3	1600.7	738.1
August	1157.4	1475.2	890.6	1530.3	1652.3	949.1
September	679.9	675.5	742.2	678.3	849.6	716.4
October	156.4	62.9	94.4	274.3	30.2	74.9
November	25.8	0	63.4	84.6	12.1	56.4
December	0.9	0	0.8	1.9	0	0
January	0	0	0	0.4	6.5	0
February	5.5	4.6	0.2	13.7	9	0

March	39.5	24.4	45.5	177.3	127.3	55.5
April	1.1	2.2	15	23.2	12.2	6.3
May	1	3.7	10.5	19.9	2.2	16.8
Total	3916.7	4134.8	3630.7	5062.1	5126.5	3560.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2008-09

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1112.1	811.1	797.7	1194.7	908.6	702.9
July	1301	760	574.9	969.6	979	514.5
August	1713	1278.3	872.2	1576.6	1542.4	819.7
September	605.9	434.4	552.7	751.2	538.5	446.5
October	49.3	120.8	3.1	25.2	32.7	59.8
November	5.2	14.7	5.7	2.3	28.8	19

December	0.2	0.4	7.1	16.7	195.2	0.6
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	12.5	13.2	0.9	30.1	17.7	18.5
April	17.9	13.6	0.6	20.9	30.5	11.3
May	15.5	45.4	15	16.4	37.1	87.5
Total	4832.6	3491.9	2829.9	4603.7	4310.5	2680.3

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2009-10

Month	Grid Points					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	600.6	494.8	715.1	573.6	428.5	634.7
July	1796.7	1895.7	1186.2	2110.9	2176.3	1609.3
August	468.7	515.5	276.1	549.3	702.3	372.6
September	580.5	584.7	380.4	534.6	598.2	360.9
October	319.9	240.6	388.9	237.5	210.7	559.8
November	93.7	103	153.8	132.1	49.5	133.7
December	12	12.9	0.2	0	2.9	0
January	15.7	53.9	6.3	5.7	33.2	0.7
February	0	0	0	0	0	0

March	0	3.4	0	0	2.5	0
April	7.5	26.5	1.1	9.1	24.7	1.4
May	44.1	5.5	72.6	66.6	12.4	55.1
Total	3939.4	3936.5	3180.7	4219.4	4241.2	3728.2

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2010-11

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	796.8	366.4	935.3	824.9	478.6	1028.8
July	1246.1	902	1197.9	1379.4	1009.2	1542.9
August	860.3	516	708.6	1191.4	653.4	781.9
September	665.4	471.2	464.7	653.6	602.2	488.1
October	288.7	121.5	268.8	408	177	278.4
November	183.9	175.8	134.5	269.5	148.7	161.6

December	8.7	3.5	7.5	1.8	0.4	1.7
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	0	0	0
April	18.2	14.1	20.7	10.8	12.7	33.3
May	4.1	4.9	6.7	13.2	11.3	12.2
Total	4072.2	2575.4	3744.7	4752.6	3093.5	4328.9

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2011-12						
Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1309.9	1309.3	862.2	1503.3	1405.3	1226.8
July	1437.3	1360.6	1013.8	1371.9	1363.5	1144.3
August	894.6	992.3	787.6	1137.8	1060.2	940.7
September	439.8	543.2	451.5	769.8	659.4	591.4
October	111.7	156	48.1	210.8	179.3	69.5
November	66.1	60.2	9.4	20.8	36.1	15.5
December	0	0	0	0	0	0
January	0	0	0	0	0	0
February	0	0	0	0	0	0

March	0	0	0	0	0	0
April	10.8	8	0.2	0.2	3.8	0.9
May	0	0.3	0	2.2	1.3	0
Total	4270.2	4429.9	3172.8	5016.8	4708.9	3989.1

MONTHLY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR TH YEAR 2012-13

Month	**Grid Points**					
	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N
June	1115.8	942.7	1142.6	907.5	942.1	1233.2
July	980.4	988.3	642.5	1344.8	1160.2	943.8
August	839.3	932.2	651.1	1132.2	1022.3	792.1
September	245.8	313.1	239.8	503.8	397.8	324.5
October	115.6	130	101.3	170.6	142.3	131.3
November	38.5	42.7	11.4	12.7	24.9	7.9

December	0	0	0	0	0.3	0
January	0	0	0	0	0	0
February	13.4	9.7	2	33.2	5.1	26.6
March	0	0	0	0	0.4	0
April	0	15.2	0	0	3.5	0
May	93.3	35.4	73.3	64.9	34.7	59.5
Total	3442.1	3409.3	2864	4169.7	3733.6	3518.9

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - VIII

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – VIII

Sl. No.

1.

D E S C R I P T I O N

Decision and findings by the Tribunal on

important questions contd…

DailyRainfall Data for the

period from June, 1901 to May,

1940

1501 - 1735

PAGE NOS

DAILY RAINFALL DATA

FOR THE PERIOD

FROM JUNE 1901 TO MAY 1940

1501

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1901 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 4.9 24.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0.9 2. 3.2 1.9 0 2.5 2.1 1.9 0.3 5.8 3.4 0 5.3 2.3 2.3 0.2 7.3 4.1 0.5 7 5.5 6.5 0.6 16 12.8 5.2 15.7 31.8 31.8 11.5 35.8 45.1 14.4 20.5 40.8 19.6 62.3 29.5 14.1 59.2 36.9 65 28.5 71 46 50.4 57 28.3 60.7 40 63.9 119.6 52.4 41.5 124.4 110.3 56.7 168.3 96.5 33.4 143.1 115. 37.6 63.2 36.3 58.7 45.4 53.4 89.4 42.7 37.3 61.3 56.2 35.1 86.8 70.8 158.3 20.2 260.9 54.1 17 172.5 26.4 120.4 22.2 210.2 59.8 17.3 96.3 39.2 118.4 9.6 207.1 69.5 15.3 159.4 58.9 42.3 13.4 59 42.8 21.9 154.6 45.3 35.2 7.9 55.8 24.3 11.1 95.4 22.8 18.9 6.8 24.8 21.4 12.2 26.9 18.6 11.2 10.1 3.7 26 18 21 24.7 6.8 3.9 6.7 5 6.3 17.9 3.3 11.1 9.3 5.7 8.7 13.4 17.1 4.1 19.6 7.5 30.5 16.3 8.6 22.4 12.5 16.6 8.7 18.5 15.5 11.7 20.5 14.8 21.8 12.4 18.1 25.9 20.1 11.1 19.9 23.1 15.4 27.8 39.2 25.3 15.6 39.4 25.1 23.3 15.4 8 42.4 20.7 92.8 8.6 10.5 5.8 53.2 18.5 16.5 62.2						

Total	1044.1 494.9 1428.1 1024.6 557.2 1329 1001

1502

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1901 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	5 6.2 7.9 5.1 0.8 15.2 6.7 17.1 26.5 24.8 5.3 1.2 27.4 11.2 8.1 12.5 5.7 20.3 13.8 23.1 27.2 66.9 86 11 176.3 169.6 9.4 169.1 15.9 22. 13.5 54.8 27.7 30.8 69 24 22 32.6 24.1 15.9 29.2 26.6 11.2 21.1 6 30.4 22.6 19.3 39 9.9 16.7 14.5 11 5.6 33.9 22.2 10.6 27.5 5.3 17. 11.8 9.3 23.7 14 15.9 20.4 20.6 11 29.1 28.2 9 22.6 9.7 23.3 24.6 38.9 40.1 27.8 42.7 25 33.2 23.8 27.6 39.7 17.3 12.3 24.1 18 13.3 25.7 21.7 39 43.7 11.5 52.9 70 19.6 39.5 19 31.9 14.4 46.1 37.7 20.7 56.8 17.2 24.6 12.7 48.6 40.6 9.6 53.3 9.8 13.6 7.7 34.3 27.5 15.7 38.3 11.4 21.9 4.4 37.6 34.5 9.5 41.7 21.4 29.5 7.5 39.7 39.4 17.8 39.4 7.2 9.9 8.9 16.2 10.5 23.2 22.6 8.8 12.2 6.8 36.1 23.2 20.6 41.4 9.9 16.1 4 43.8 21.8 13.4 51.8 9.3 18.3 5.4 44.5 22.9 4. 51.4 21.8 12.8 35.4 49.4 20.3 35.3 58.9 16.4 15.7 9.5 27.8 24.2 17.9 26.9 8.4 7 9.6 8.7 10.9 9.7 9.1 5.6 5.9 2.4 10.8 10.2 6.3 12.6 11.8 10.8 7.1 13.6 20.2 5.4 9.2 7.4 8.1 7.9 23 11.6 11 25.3 8.3 9.1 4.5 19 9.4 14.1 21.6 5.5 7.6 0.2 9.4 10.5 0.6 7						

Total	475 633.3 360.8 1001.8 787.1 574.1 1131.2

1503

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1901 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0 0 0 0 0 0 6.4 2.4 13.1 4.2 3.2 4.1 3.9 4.6 18.3 1.4 0.3 2.4 0.9						
15	0.2 0.3 0.2 0.9 4.2 0.4 4.3 8.2 1.4 3.6 1.6 5.9 0.9 0.6 7.9 0.1 2.2 0						
16	9.1 3.2 0 11.6 3.5 5.1 0.2 9.4 9 0 8.4 12.9 20.8 0 11.5 18.4 0 4.3 5						
17	7.4 0.1 8.5 11.3 0 7.1 0 0 0.2 3.3 0.3 0 4 0 0 0 0 0.1 0 0 0 0.1 0 0 (						
18	0 0 0 0.4 0 2.9 0.3 0 3.6 1.2 1.6 0.1 5.1 3.5 0 5.2 0 0 0 0 0 0 0 1.1						
19	1.5 0 0.8 2.9 0 0 2.4 2.4 0.7 1.5 3.3 0.3 2 0 0.3 0.1 5.4 1.3 0 6.7 0						
20	0.2 6.9 0.4 0 8.6 0 0 0 0 0 0 0 0 1 0.3 9.1 3.5 0 13 0 0.8 0 0 0.8 0 (						
21	2.6 13.2 0.3 0 4.7 19.6 8.5 0 0 0 0 0 1.7 1.3 0.6 2.5 0.1 0 0 0.6 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	42.3 83.8 19.6 88.1 69.9 32.1 104.5

1504

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1901 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.2 0.8 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0.6 0.1 0 0.2 0.4 0 0 0 0 0 0 0.7 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.4 0.3 0.5 16.2 6.4 0 20.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	3.9 1.1 1.1 16.3 6.7 0.2 22.1

1505

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1902 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1506

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1902 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0.4	0.4	0.3	0.5
16	1.4	3.9	0	7.3	0.3	0.9	0
17	0	0	0.6	2.4	0	0	1.1
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.3	0	0	0.4	1.1	0	0.3
16	0.4	0	0	0.5	4.1	0	2.1
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.4	0	1.7	2.6	7.6		
16	8.4	4.8	3.9	0	0.5	0	0
17	0	0	0	0	0	0	0
18	0	0	0.2	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Total	4.8	17.2	0.3	4.3	14.5	4.8	12.9	Total	14.3	44.1	7.7	23.3	64.9	37.1	49

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1902 : Month -June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	4.1 2.2 0 2.7 8.9 0.5 3.3 0 0 0 0 0 0 0 0 1.1 0 1.1 4.7 2.1 1.1 5.5 9 1.5 3.2 3.6 0 5.4 0.8 0 0.5 0.7 0 0.5 0 11.5 0.1 11.4 9.4 0 3 1.7 93. 2.4 118.9 94.9 2.3 50.6 23.7 48.3 3.6 49.5 44.9 1.9 31.9 10.5 63.6 14 83.5 65.6 8.7 84.6 39.4 96.7 53.2 113.8 92 30.9 111.8 83.5 42. 23.8 47.2 42.7 25.8 35.6 46.8 85.4 38.2 107.6 95.8 34.6 59.9 92.6 101.5 61.4 110.2 100.4 51.7 147.5 123.4 44.2 53.4 41.1 49.3 51.3 58.8 72.3 105.1 48 140.7 113.2 42.1 136.4 107 25.4 7.7 29.1 27.3 19.5 12.9 8.3 4.4 10.2 8.1 2.9 8 3.8 11 1.1 12.5 11.6 0.9 12.1 3.9 1.2 0 0.9 1.5 0 0 0 2 0 1.7 2.6 0 1.6 0.3 1.4 0 1.1 1.8 0 0 0 7.7 0 6 7.5 0 4 0.5 0.7 1.3 0.3 0.6 0.5 1.5 1.9 5.6 1.1 6.8 5 0.5 5.5 1.7 4 0 2.7 4.2 0.1 0.7 0 2.3 0.2 1.6 2.5 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.2 1.1 11.3 2.7 12.2 11.2 1.1 2.8 1.6						

Total	783.4 329.5 911 800 277.5 779.4 638.4

1508

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1902 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	4.1 7.5 2.3 3.4 4.2 1.7 6.8 5.7 12.9 1 2.6 6.5 2.9 5.5 5.7 11.4 1.6 1 4.4 0.9 0.6 11.4 0 19.5 10.8 0 10.3 5.4 2.7 0.9 1.7 1.1 0.4 8.3 3.1 2.6 0.4 1.2 1.2 0.3 0.3 0.2 7.3 0.1 8.6 8.4 0 1.8 1.1 1.4 0.2 0.8 1.3 1 0.3 0 0.4 0 0 0 0 0 0 0 0 0 0 0 2.2 1.4 3 1.6 0.5 3.9 1.3 3.7 0 5 2.4 0 16.3 6.8 1.8 0 3.8 1.9 0 2.9 1.4 1.3 2 1.3 0.6 0.8 11 4.6 0 0 0 0 0 0 5.4 0 8.8 6 0 2.5 1.5 16.1 8.3 15.6 17.1 5.5 9.1 4.3 0.9 0.2 0 0 1.1 0.8 4.4 0.4 7.6 4.2 0.1 2.5 1.5 19 11.5 16.3 18.8 8.5 12.8 14. 23 3.9 31.4 23.6 2.8 44.4 17 5.5 2.7 7.4 5.3 2.9 28.1 10.6 1.6 1.3 0.4 0.8 0.7 5.5 4.7 13.1 0.3 16.5 13.9 0.2 4.7 2.5 21.1 4.4 25.3 22 11.7 15.9 8.4 37 8.9 51.2 36.9 4.8 45.2 37.1 8.3 18.7 2.4 9.6 14.9 17.4 44.4 22.5 11.4 19.4 26.4 9.3 36.8 29.1 32.8 21.3 35.7 34.5 20.7 27.8 30.9 9.6 16 10.1 11.6 18.5 59.4 35.8 52 50.9 46.4 48.4 45.5 57.7 64.1						

Total	322.2 197.4 344.5 315.9 163.2 432.2 344.3

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1902 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0	0	0	0	0
15	25.7	4.9	9.3	2.5	5.1	4.9	4
16	0	1.3	0.6	0.2	0	0.3	9.6
17	1.3	2.7	8.1	7.6	7.2	9	5.6
18	5.1	1	4.4	0.4	3.8	14.9	1.6
19	0	0.5	0	0	0	0	0
20	6.5	0	1	14.1	0	0.6	0
21	0.4	0	0	4.2	4.9	2.9	2.3
22	13.3	6.6	18.2	18.8	17.3	13.5	13.6
23	5.4	2.9	0	0.5	0	0.2	1.1
24 25 26 27 28 29 30 31							

Total	104.1 168.4 66.3 89.7 159.1 106.8 146.2

1510

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1902 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.3 22.7 29 18.8 27.7 47.6 6.2 21.1 15.4 16.2 16.2 16.5 12.7 24.2 27. 7.1 35.8 0 12.7 51.8 0 6.7 15.5 61.4 0 6 69.1 0 4.4 0.3 1.6 0 0 0.7 0 6.4 0 8.4 7.8 0 2.4 1.8 19.1 0 25.8 22.6 0.1 25.7 7.3 3.5 4.3 4.4 7.3 6.8 8.4 19.7 0 0 0 0.2 0.7 0 1.5 0 0 0 0 0 0 0 0.4 0 0 0.5 0 0 3 0.2 0 0 0.2 0 0.5 7.1 22.8 0.2 4.4 11.5 2.7 24.3 0 0 0 0 0 0 0 0 0.3 0 0 1.6 0.7 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	97.5 172 73.8 105.7 201.2 73.5 118.5

1511

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1903 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1512

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1903 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	1.2	0	0
22 23 24 25 26 27 28 29 30							

Total	0 2.5 0 1.1 4.7 0 5.1

1513

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1903 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 2.3 0 0 0.2 0 0.5 0 0.9						
13	1 7.4 0 0.9 0 0 0 0 0 0 0 0 0.4 0 0 0.5 0 0 2.3 5.5 2.8 3.2 6.9 6.3 3						
14	0.3 1.6 0 0.4 1.7 0 0.3 0 0 0.3 0 0 13.3 5.2 3.1 11.4 1.5 6.5 20.5 0.						
15	3.1 4.6 3.7 5.9 9.4 5 21.3 42.7 27.8 24.6 22.3 32.6 33.2 50.2 43.9						
16	26.4 28 26.6 21.9 20.6 63.8 29.5 37.5 34.1 27.6 24.4 21.4 38.2						
17	35.4 9.8 2.2 12.5 10.7 2.6 20 18.5 43.5 0.5 64.2 48.5 1.9 39.8 21.						
18	10.9 5.4 14.1 10.8 11.6 33.7 9.5 81.4 5.1 105.1 87.5 5 51.3 21.6						
19	31.9 2.6 39.8 31.4 1.1 20.9 12.5 33 19.3 28.6 23.3 9.9 42.6 19.3						
20	58.5 3.6 80.6 64.1 3.4 89.3 47 42.6 2.1 57 46.1 1.3 48.1 17.7 40.3						
21	3.2 53.3 37.4 1.5 65.6 19.4 19.2 6.3 21.2 17.2 3.4 25.5 9.3 16.8 2						
22	15.4 17.4 1.2 28.4 6.1 13.1 0.8 12.9 15.2 1.1 3 1.9 11.4 6.1 11.4						
23	11.1 3 19.1 11.6 12.4 2.3 11.2 10.4 1.8 15.5 11.9 9.6 2.1 10.1 9.6						
24	2.2 9.4 4.9						
25 26 27 28 29 30							

Total	536.7 176.9 624.4 540.1 168.4 705.8 397.2

1514

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1903 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.5	20.9	11.6	10.1	13.3	22.7	19.7
13	19.7	12.1	16.3	10.2	8.8	13.5	14.6
14	18	11.6	7.1	14.2	14.2	10.4	14.5
15	24.3	12.1	25.9	25.5	11.4	22.5	17.8
16	12.8	6.3	16	12	3.6	7.6	5.6
17	0	0	0	0	0	0.3	0.2
18	63.6	3.4	37.3	19.6	5.9	2.7	6.2
19	23.4	17.5	17.5	11.6	19.7	15.7	9.9
20	13.5	5.5	45.4	9.5	57.1	39.8	6
21	33.8	36.3	16.1	16.2	16.5	16	15.7
22	12.2	5.8	15.8	11.8	3.7	14.4	7.8
23	5.7	1.4	4.3	9.9	5	10.8	12.9
24	46.5	34.9	12.9	76.7	50.3	55.3	28
25	25.6	21.2	18.7	17.1	33.4	13.5	5.5
26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.2	25.2	20.8	12.5	23.6		
13	12.1	22.1	6.9	6.8	14.9	21.5	
14	13.3	5.2	6.8	5.4	5.1	5.8	16.8
15	17.8	19.1	8.8	20.6	16.5	4.4	9.8
16	1.5	2.9	1	0.9	2.3	0.4	1.8
17	0.2	0.6	0.8	0	0.4	7	0
18	4.1	1.6	8.8	7.8	25.3	7.5	32.3
19	9.9	32.8	17.9	14.3	2.1	17.1	13.4
20	70.5	33.4	22.8	22.4	21.9	22.1	15.5
21	15.7	13.3	15.6	1.2	1.9	1.3	1
22	7.8	9.3	9.6	12.4	9.6	10.1	25.7
23	12.9	12.3	16.7	13.7	10.5	25.8	20.4
24	62.7	45.7	14.8	55.4	29.2	23.6	
25	3.4	3.9	4.1	13.5	5.6		
26 27 28 29 30 31							

Total	510.1 301.3 585.3 472.8 237.5 647.8 441.2

1515

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1903 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.5 6.9 0 4.8 18.7 0 1.8 0 0 0 0 0 0.7 0 12.9 1.7 18 12.7 0.8 10.6 8.7 7.4 5.2 6.1 9.4 6.4 8.2 6.5 13.4 3.4 14.5 13.8 2.5 6.7 4.9 0 0.6 0 0 1 0.3 0 0 0 0 0 0 0 0.4 0 0.7 0.4 0 0.3 0.2 0.1 0.4 0 0 0.1 0.7 0 9.1 0 12.9 10.8 0 6.2 4 1.3 0 1.3 1.6 0.7 5.5 4 0 0 0 0.5 0 0 3.3 0 0 0 0 0.1 0.7 0.3 0 0.5 0 0 0 0.2 0 2.3 0 1.9 3.1 0 0 0 0.6 2.6 0 1.9 3 5.1 9 0.1 2.1 0 1.8 6.1 0 0.7 0 0 0.5 2.6 2 26.1 27.6 6.7 5.6 7.7 13 17.6 22.5 20.5 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.9 0 0 1.9 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	54.8 33.2 63.6 77 60.7 94.5 91.8

1516

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1903 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	3.5 3.6 4 4.6 2.2 4.8 9.9 0						

Total	3.5 3.6 4 4.6 2.2 4.8 9.9

1517

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1904 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0 0 0 0 0 0

1518

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1904 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	3.2	8.5	2.5	9.9	21.3	2.8	5.9
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0.5	0	0	0	0	0
21	0	0	0	1	0	0	0.8
22							
23							
24							
25							
26							
27							
28							
29							
30							

15	26.1	24.7	17.3	20.9	16.7	5.8	6.2
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	1.3	0
20	0	0	0	0	0	0	0
21	0.7	0	0.6	3.8	0	0.2	

Total	29.3 36.2 19.8 32.7 47 8.6 12.8

1519

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1904 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 2.8 0 5.6 2.8 0 3 1.6 1.3 0 0 0 1.7 0 0 2.3 0 0.7 1.1 0 0.5 0 2.8 0 1.2 2 0 0 0 19 2 31.5 17.3 1 11.2 6.2 31.4 16.1 36.1 32 32.8 22.3 9.4 54 2.2 48.7 53.4 3.6 44.6 29 66.5 10.1 89.7 67.5 7.6 73.8 35.5 93.4 63.1 101.5 89.5 49.6 158 100.7 84.9 78.3 95.7 87.3 67.2 142.8 128.1 42.3 49.3 50.9 63.9 82.2 94.8 117 55.8 42.9 64.7 58.1 45.8 82.1 72.4 25.6 17.1 28.2 21.8 9.5 19.3 19.9 21.7 11.4 21.1 19.2 7 38.6 16.3 6.9 3.3 3.6 2.4 1.5 32.2 11.1 61.5 11.9 83 65.5 9.1 92.8 48.2 10.2 12.5 8.5 6.5 7.2 14.4 7.2 118.5 6.1 160.8 127.8 2.6 76.4 32.5 72.4 96.2 51.8 60.6 76.5 79.6 114.1 46.4 119. 13.3 30.4 74.6 22.4 97.3 6.1 10.6 3.1 6.2 8.3 9.2 25.4 5.8 5.8 3.4 7.2 2.9 7.2 26.8 39.5 17.3 62.9 35.1 10 47 28.3 62.6 29.6 74.6 70 28 71.9 69.5 66.1 33.2 82.5 63.1 20.9 115.2 69.9 26.6 53.9 9.3 23 42.1 35 85.5 33.3 28.7 36.4 35.3 22.6 54.7 51.3 2.8 3.7 1.6 3.2 2.5 4.8 9.2 28.9 43.4 21.4 29.3 51.9 31.2 48						

Total	1091.4 768.3 1191.8 1083.7 669.1 1385 1260.4

1520

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1904 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.9 12.2 2.6 2.3 5.2 4.5 5.4 26 2.2 34.9 27.1 0.9 30.2 16.1 16.2 4. 22.9 16.6 3.4 15.9 14.3 5.6 8.4 4.9 5.4 6 9.7 10.9 10.5 11.8 9.7 10 14.4 33.2 31.9 32.6 22 47.3 36.8 36.2 44.6 47.2 7.3 13.6 3.1 5.2 8.1 7 8.6 11.7 15.8 6.5 6.6 10.7 6.4 9.4 24.1 71 10.8 29.3 87.6 17. 43.8 26.9 57.5 15.1 25.2 45.2 17.1 51.3 27.6 57.2 14.9 20.5 44.6 15.1 27.7 6.8 18 2 6.5 15.7 20.1 26.3 2.2 4.5 2.1 2.4 4.3 1.1 3.5 0 2.4 0 1 3.1 0.7 2.2 1 3.1 0 0.9 3.7 1.1 1.4 1.5 2.6 1.3 1.5 2.1 9.5 7 2.1 2.8 2.4 1.8 1.5 10 7.5 3.3 0.9 4.7 3.1 1.5 3.8 3.1 1 0.7 0.7 2.4 3.1 9.5 9.4 5.7 1.7 7.7 5.7 2 11.5 11.5 2.9 8 0.8 1.6 5.2 4.9 6 2.1 4 0.9 1.6 3.4 8.8 9.2 1.6 1.9 1.9 1.4 1.6 2.1 2.3 3.5 3.2 3.7 3.7 2.2 3 3.5 2.9 8.2 1.1 0.7 4.1 18.8 8 0.3 0.8 0.4 0.3 0.5 0.6 0.1 0 0.5 0 0 0.3 1.7 0.3 0.4 0.1 0.3 0.4 0.4 1.4 0 0 0.2 0 0.2 0.8 0.5 0 2.8 6.5 0 1.2 3.8 0.8 0.1 4 3.1 2.7 4.9 2.5 11.2 7.2						

Total	241 349.2 205.9 227.2 324.1 323 376

1521

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1904 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0.4 0 0 20.9 8.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.5 0 1.1 5.7 0 0.4 25.8 7 37.7 27.3 5.4 39 16.1 1.2 0.4 2.4 1.2 0.4 7 1.2 0.3 0 0.5 0.4 0 0.1 0 3 0.9 2.3 1.3 0.4 0.8 0.5 0.5 0.1 1.1 0.6 0 0.4 0.2 0 0 0.1 0 0 2.8 0 0 0 0 0 0 0 0 5.3 8.4 3.9 4.2 8.4 14 6.4 7.5 13.5 3.1 4.3 5.4 10.2 6.4 2 4.1 2.1 1.5 2.5 3.2 1.3 0 0.2 0 0.1 0.3 0 0.8 3.2 0.9 3.8 5.1 3.8 3.3 3.2 2.9 14.5 0 4.3 24.1 2.4 4.6 1.3 5.7 0.1 2 8.6 6.2 4 0.3 4 0 0 2.5 0 0 9.5 3 7.6 10.1 1.3 0.8 2.6 0 0 0 0 0.3 1.1 0 0 0 0 0 0 0 0 0 0.4 0 0.4 1.3 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	62.8 65.6 65.1 63.9 70.4 112.2 56.4

1522

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1904 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1523

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1905 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1524

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1905 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 3.4 16.3 0 6.3 22.5 0 11.5 0 2.9 0 1.1 5.1 0 0.						
19	0 0.3 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 1.1 0.7 2						
21	1.4 1.6 0.7 0.5 0 0 0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	4.5 20.2 2.1 8.8 29.6 0.7 12.4

1525

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1905 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0 2.4 1.2 0 1.1 0.5 0.5 0.4 0.7 0 0 0 3 0 5.6 3.2 0 1.8 1.1 0.5 0 0.2 0.3 0 0 0 0.7 0.4 0.9 0 0 0.2 0.1 5.1 0 3.6 2.1 0 7 2.7 32 19.9 21.2 22.1 24.4 28.5 15.3 17.3 31.4 7.4 10 28.5 8.8 6.6 2.6 0 2.9 2.9 0 0.6 1.8 0.6 0 0 0 0 1 (15.7 0 19.1 15.6 0 13.3 5.7 18.2 4.2 26.1 18.5 1.8 26.1 11.9 30.2 6.2 38.6 33.4 3.2 51.1 20.7 45.4 20.3 49.1 43.9 11.1 20.2 11.1 2 0 2.3 1.9 0.2 5 3.6 23.9 1.1 30.6 27.7 0.4 25.1 10.3 14.2 1.4 17.8 12.6 0.8 7.8 3.2 78.5 1.1 109.7 76.8 1.8 38.8 18.4 27.1 2.3 15.2 19.5 0.8 10.8 3.3 10 2.1 15.6 9.6 0.8 28.1 16 5.5 0.5 8.5 6.5 0.4 7 3.2 22 1.6 18.3 27.8 2.9 12.7 7.4 50.8 4.6 67.3 54.9 3.4 95.8 38.9 128.7 16.1 176.7 134 13.5 94.2 49 35.4 16.2 38.5 33.3 8.1 63.2 30.7 6.1 7.8 2.5 4.7 9.9 3.4 10.7 29.2 19.4 23.1 29.6 15.1 10.5 12						

Total	606.4 157 703.6 593.6 127.1 562.4 284.8

1526

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1905 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.6 1.5 0.4 0.9 1.5 0.9 2.5 2.2 2 2.5 4 4.2 6.4 10.8 12.8 12.6 9.6 8 6.2 11.3 15.5 5.1 5.4 6.2 4.9 3.2 21.1 15.1 20.2 12.2 27.2 17.6 8.6 18.6 13.4 30.7 23.2 24.7 29.3 16.5 34.5 23.4 7.6 2.3 6.2 7.1 1.7 1 8 3.1 5.5 1.9 3 5.9 5.1 7.9 4.4 2.4 5.9 5.3 2.4 11 10.8 0.4 0.5 0.4 0 1.2 0.2 0.7 6 3.9 5.3 5.9 2.6 3.8 4.6 5.6 10.7 2.5 9.9 13.2 27.5 53. 11.2 21.2 3.5 6.2 16.4 16.9 20 31.5 8.1 36 31 4.3 27.5 16.2 18.6 2 20.1 22.2 1.8 14.5 16.9 4.9 3.7 4.7 4.9 3.6 10.5 2.9 9.5 5.6 7 5.8 3.9 19.9 9.1 6 2.8 4.3 4.8 1.1 4 1.1 5.1 3.8 1.8 4 7.8 10.9 4.1 3.5 2.2 3.1 2.9 1.4 2.6 1.6 2.9 0 3.5 3.2 0 0.9 0.5 1.9 1 1.3 2.1 1.6 0.5 0.8 16.5 9.7 12.8 14.9 4.7 14.8 9 16.9 13 11.5 10.9 8.2 19.6 18.2 17.7 18 12.7 20.8 16.1 24.3 57.2 4.4 5.3 0.9 1.3 3 4.4 4.1 0.8 1.6 0.2 0.2 0.6 1 1.2 3.9 2.6 4.6 5.5 4.4 5.5 7.3 9.5 3 12.5 10.2 2.4 5.6 7.7 10.7 1 10.4 11.9 1.6 14.4 6.8 2.5 2 0.8 1.2 0.7 0.3 1.2						

Total	276.7 189.7 244.5 261.3 150.8 348.5 351.8

1527

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1905 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	3.3	9.1
17	3.1	1.9	0	2.7	2.1	0.6	1.1
18	0	0	3	2.2	2.6	2.9	1.6
19	2.2	5.5	0.5	3.6	0.4	1.3	0
20	27.3	10.2	6.8	11.2	8.8	3.8	15.5
21	0.5	0	0.5	0.7	0	3.4	1.4
22	0	0	0	0	0	0	0
23	0	0	0				
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	3.3	9.1
17	3.1	1.9	0	2.7	2.1	0.6	1.1
18	0	0	3	2.2	2.6	2.9	1.6
19	2.2	5.5	0.5	3.6	0.4	1.3	0
20	27.3	10.2	6.8	11.2	8.8	3.8	15.5
21	0.5	0	0.5	0.7	0	3.4	1.4
22	0	0	0	0	0	0	0
23	0	0	0				
24 25 26 27 28 29 30 31							

Total	131.1 111.4 127.5 107.6 86.3 114.9 86.9

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1905 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1529

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1906 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1530

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1906 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0.6 0 0 0 0 0 0 0 0 0 0 1.2 0 0.6 3.5 0 0.2						

Total	0 1.2 0 0.6 4.1 0 0.2

1531

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1906 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	0.2	0	0	0.7	3.7	0	0.1
14	1.4	2.2	4	6.1	1.5	0	1.5
15	1.9	1.3	2.9	2.5	4.4	17.1	5.9
16	6.1	31.7	27.1	2.7	18.3	8.5	69.8
17	13.6	112.9	87.6	5.8	80.8	30.6	45.7
18	82.9	14.7	118.8	81.5	6	68.6	31.9
19	23.9	19.2	6.1	23.6	10.2	37.9	40.5
20	65.9	70.8	47.8	88.8	83.8	44	60.1
21	6.8	10.9	12.3	13.4	33.5	3	3.6
22	9.6	11	13.2	3.4	8.3	0.5	4.3
23	29.9	20	1.1	1.4	1.2	1.9	3.1
24	2.2	2.4	3.6	1.8	4.4		
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0.2	0	0	0
13	0	0.7	0	0	7.7	23.9	0
14	0	0.5	0.6	11.9	0.6	16.7	10.2
15	3.7	55.4	34.8	1.8	33.1	13.4	30.7
16	73.2	66.6	18.2	29.5	14	84.8	
17	50.5	44.7	5.6	41.8	16.3		
18	0.7	5.9	5.1	0.4	19	2.9	22.6
19	40	46.2	51.9	40.6	67.5	53.	
20	30	32.9	39.7	34.4	40.9	7.2	11.8
21	3	4.6	3.6	9.9	16.9	12.4	10.4
22	8.8	11.5	16.8	15.8	20.6	19.8	20
23	7	1.9	1.7	2.3	2	1.6	6.3
24							
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0

Total	600.2 334 680.6 587 269.7 628.2 443.1

1532

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1906 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	11.1 6.7 15.8 10.4 3.6 9.2 13.9 10.4 4.4 12.3 11.4 3 19.4 11.7 6.1 4.8 8.6 6.2 6 14.1 9.3 7 4.8 8.3 8.1 5.8 13.6 9.5 15 3.6 15.4 17.1 3.8 7.7 6.3 2.5 0.8 3.8 2.7 0.3 10 5.2 2.7 1.3 2.6 1.6 0.9 10.3 4.1 10.4 1.1 13.8 9.3 0.5 9.1 5.4 0.7 0 0.5 0.5 0.1 1.2 1.4 1.7 0 1.6 2.2 0 1.8 0.9 3.2 0 4.1 2.3 0 5.1 1.8 4 0 5.4 3.9 0 2.8 0.9 0 0 0 0 0 0 0 4.8 0.3 5.8 6.3 1.2 1 0.9 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 5.4 13.1 3.1 10 19 9.6 2 3.1 2.7 2.9 5.9 35.6 20.2 13.5 7.3 12.4 14.9 5 11.6 4.2 4.8 14.6 0 1.3 6 2.4 8.8 14.1 10.6 14.6 12.3 9.1 24 11.3 1.5 3.5 0.8 3.4 7.2 43.1 26.6 60.3 14.7 80 69.9 18.7 120.5 59.7 12 6.5 7.4 7.5 3 10.2 4.8 40.2 13.9 48 42.5 16.5 61.5 49.6 59.7 41.1 59.4 62.8 37.8 67.7 65.1 27.4 58.1 13.4 24.8 40.5 57.6 71.7 5.4 16.9 0.3 3.1 12.4 7.3 14.6 6.7 12 5.4 6.1 9.5 6.6 11.9 9.1 14.1 8.4 8.5 9.3 7.5 19.6 1.1 5 0.1 2.9 7.1 5.2 10.4						

Total	342.8 262.3 354 347.9 223.3 585.1 459.9

1533

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1906: Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0 0 0 0 0 0 1 3.3 0 0.1 1.8 0 0 1.4 4.1 0 1.7 5.3 0 4.9 0 3.6 0 0 2						
15	0 0 3.9 11.1 0 0 4.4 0 0.5 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0.2 0 0 0.						
16	0 0 4.8 15.3 0 1 6.8 2 5.7 1.8 6.7 1.8 1.3 5.1 4.8 3.8 4.3 16.1 1.1						
17	4.1 20.6 0.5 1.6 0 0.2 0 0 0 2 0.6 0.2 0.7 0 0 0.2 2 0.8 0 0 0 0 0 0						
18	2.8 0.5 5.6 3.7 1.5 1.9 5.9 0.4 2.6 0.5 0.7 2.1 12.7 7 2.6 4.3 2.3 1.						
19	3.1 6.2 2.5 3.2 7.1 0.9 2.2 4.9 3 2.5 6.7 1.7 9.2 8.3 2.9 3 2.3 10.9						
20	15.4 8.1 6.7 6.8 9.3 4 1 0 0.8 1.3 0 1.5 0.6 3.9 7.5 1.5 4.4 9.6 6.3						
21	3.4 10.9 10.1 12.2 13.3 24.4 3.4 5.9 7.2 0 9.6 8.6 0 2.1 1.3 6.9 12						
22	7.1 8.2 18.7 4.8 3 7.8 11.1 7.5 4.3 4.5 5.8 1.4 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	81.7 133.8 68.2 71.7 125.3 71.3 58.2

1534

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1906 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 6.8 19.1 0 0 7.6 0 0 0 3.1 0 2.3 7 0 5.9 0 0 0 0.1 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0 0.9 1.4 0 0 0 8.1 12.2 6.7 5.8 6.7 2.3 13.9 0.4 1.6 0 0.9 3.5 0 0.3 0 1.5 0 0 0 0 0.3						

Total	16.4 37.5 7.6 10.5 24.8 2.3 21.3

1535

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1907 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1536

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1907 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0.1 0.5 0 0 0 0 0 0						
15	0 0 1.8 0 0 0 0 0 0 0.5 0 0 0 0 0 0 4.8 13.7 0 0 5.3 0 0.3 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0.2 5.3 0 3.9 12.8 0 3 4 13.9 0 9.7 11.1 0 51.1 0						
17	0.4 0 0 0.4 0 0 6.8 18.2 0 0.7 7.2 0 4.5 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10.3 29.7 0 1.2						
19	13.2 0 5 17.1 10 23.5 25.9 22.2 11 30.2 17.9 0.2 30.4 15.9 0 14.9						
20	9.4 3.1 1.6 5.8 3.5 2 2.4 1.3 3.8 12.4 0 1.8 9.3 0 3.4 1.3 3.9 0 0.7						
21	2.1 0 3.2 1.4 5.2 0.7 1.5 10.6 0 0.4 4.1 1.8 1.3 0.9 1.2 0.4 0.3 0 0						
22	0 0 0 0 0 0 0 0 0 0 0						
23							
24							
25							
26							
27							
28							
29							
30							

Total	74.8 116.4 61.7 66.1 97.9 28.7 114.4

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1907 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	0	0.2	0	1	0	1.3	1.2
14	0	0	1.2	0	0	6.1	1.4
15	17.2	3.4	7.4	19.5	2.1	7.6	27.4
16	43.6	39.5	7.7	36.4	11.4	16.9	8.1
17	106.7	90.1	12.1	92.9	52.7	79	49.2
18	60.8	52.4	28	71.9	67.9	19.9	21.9
19	21.1	23.1	29.4	99.6	74.4	10.1	26.1
20	4.4	0.4	1.1	0.5	2.5	1.5	3.3
21	1.5	1.2	2.6	1.8	1.3	24.5	11.4
22	9.5	47.7	39.2	5.9	55.1	33	56.8
23	45.4	33.6	9	34.9	25.2	49.7	13.7
24	112.2	73.5	36.9	40.7	26		
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	0	0.2	0	1	0	1.3	1.2
14	0	0	1.2	0	0	6.1	1.4
15	17.2	3.4	7.4	19.5	2.1	7.6	27.4
16	43.6	39.5	7.7	36.4	11.4	16.9	8.1
17	106.7	90.1	12.1	92.9	52.7	79	49.2
18	60.8	52.4	28	71.9	67.9	19.9	21.9
19	21.1	23.1	29.4	99.6	74.4	10.1	26.1
20	4.4	0.4	1.1	0.5	2.5	1.5	3.3
21	1.5	1.2	2.6	1.8	1.3	24.5	11.4
22	9.5	47.7	39.2	5.9	55.1	33	56.8
23	45.4	33.6	9	34.9	25.2	49.7	13.7
24	112.2	73.5	36.9	40.7	26		
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	0	0.2	0	1	0	1.3	1.2
14	0	0	1.2	0	0	6.1	1.4
15	17.2	3.4	7.4	19.5	2.1	7.6	27.4
16	43.6	39.5	7.7	36.4	11.4	16.9	8.1
17	106.7	90.1	12.1	92.9	52.7	79	49.2
18	60.8	52.4	28	71.9	67.9	19.9	21.9
19	21.1	23.1	29.4	99.6	74.4	10.1	26.1
20	4.4	0.4	1.1	0.5	2.5	1.5	3.3
21	1.5	1.2	2.6	1.8	1.3	24.5	11.4
22	9.5	47.7	39.2	5.9	55.1	33	56.8
23	45.4	33.6	9	34.9	25.2	49.7	13.7
24	112.2	73.5	36.9	40.7	26		
25 26 27 28 29 30							

Total	688.7 382.9 760.2 641.5 250.7 777.9 508.1

1538

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1907 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	16.1	32.1	9.7	13.9	25.5	15.7	27.7
12	61.9	132	37	55.7	108.7	94.8	132.9
13	99.1	12.8	26.7	5.9	9.7	15.5	17.4
14	25.7	14.3	31	7.7	9.6	20.1	12.9
15	52.1	21.9	39	14	21.3	35.2	28.5
16	40.8	26.1	41.8	20.7	18.2	28.1	29.8
17	45.8	42.4	21	59.4	5.6	20.2	59.3
18	65.3	77.2	25.4	48.5	17.3	22.8	34.7
19	49.4	34	71.7	10.3	15.4	11.2	17.4
20	38.3	60.2	58.5	15	27.4	12.8	10.5
21	7.1	11.5	12.8	7.1	13	3.3	4.9
22	15.1	5.2	4.4	4.9	6.7	6.8	7
23	17.9	16.1	16.8	13.2	15.8	15.9	21.4
24	9.5	10.4	14.9	26.6	34.8	6.7	11.3
25	13.9	3.4	13.2	5.6	3.6	2.9	4.7
26							
27							
28							
29							
30							
31							

Total	654.5 1109.6 500.2 606.5 919.5 812.2 1146.6

1539

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1907 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0.1 0 0.1 1.8 0 0 1.1 4 0 0.2 1.7 0.1 0.7 0 0 0 1 0.3 5 8.2 0 0.3 0						
16	0 0 0 0 0 0 0.1 0 0 6.3 2.5 0 0 0 0 0 0 0 0 1.3 0 0.2 0 0 1.1 0 0 0 0.1						
17	0 0.8 0 0 0 0.1 0 0 0.8 0.2 1 0 0.4 1.7 0 0.2 0 0 0 0 0.3 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 1.5 0 0 0 0 0 3.9 1.6 0 0 0 0 0.1 0.9 0						
19	0 0 0 0.2 0 0 1.1 0 0 0 0 0 0 0 0.7 0 1.1 0.6 0 0.4 0.2 11.4 8.7 9.6						
20	9.2 3.5 1.9 1.2 10 28.8 0 0.5 12.5 4.7 3.1 1.4 4 0 0 1.9 0 0.5 0 0 0						
21	0 4.5 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23 24 25 26 27 28 29 30 31							

Total	24.8 48.2 10.8 12.9 24.6 26.8 25.2

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1907 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0.5 1.3 0 0 0.5 0 0 0.7 0 1.3 0.7 0 0.5 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	1.2 1.3 1.3 0.7 0.7 1.3 0.3

1541

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1908 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1542

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1908 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	3.5	10.1	0	0	3.9	0	0
16	60.2	0	3.2	35	2.3	2.2	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	1	0	0	0
20	0.1	0.4	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	25.4 76.3 0 6.3 45 4.7 15.9

1543

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1908 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 2.6 7.6 0 3.3 10.2 0 0.9 5.4 16.2 0.1 3.9 19.5 5.5 9.7 47.8 19.8 39.8 35.7 11 15.5 5.9 55.6 8.6 68 49 6.8 70.4 34.4 67.9 17.3 85.1 66.8 15.3 104.9 48.1 21.1 5.1 22.3 20.5 5 59.6 35.2 54.7 18.8 68.1 60.8 20. 71.3 51.4 38.1 16.7 35.2 33.1 12.5 46.2 31.4 5.9 10.6 5.4 8.8 12.4 7 23.5 3.7 10.2 0.6 2.9 8.4 9.1 11.1 2.4 13.4 0.4 8.6 26 7 17.6 2 2. 2.1 3.3 5.9 15.4 8 12.4 5.5 15.2 12.3 9.7 16.5 8.7 29.4 14.2 30.2 25.3 6 30.8 13.4 9.2 17 1.1 4.8 8.8 6.7 18.9 6.3 6.1 9 9 12.7 6.1 6 7.3 2.9 9.5 6 1.2 5.3 3 18.7 0.6 22.6 20.5 1.3 16.4 6 31 7.9 33.1 2 5 25.7 12.5 46.4 22.1 45.8 41.5 12.5 47.1 25.2 89.1 24.9 110.3 87 16.7 103.6 53						

Total	557 248.4 604.5 531.5 227.8 670.3 424.6

1544

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1908 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	12.8 16.7 10.2 12.5 15.8 29.7 29.2 27.6 73.3 8 26.3 63.2 40.7 88. 24.9 52 18.8 24.2 51.7 45.3 58.9 17.6 28.2 11.5 18.4 30.4 29.5 39 20.1 20.7 20.6 18.9 19.5 22 29.7 41.9 30.6 35.1 33.1 18.5 58.3 33.5 60.6 34.2 65.5 56.4 18.2 46.9 40.2 14.4 18.9 11.1 11.9 12.7 21.7 25.8 3.4 7.2 2 4 6.4 22.5 20.9 3.7 4.1 1.9 3.8 3.2 1.6 3.1 10.6 6.9 7.9 9.8 6.1 6.6 5.3 11.9 9.1 13 10.5 6.7 15.2 10.3 11.5 16.9 7.7 8.6 12.4 10.1 16.5 5.6 4.5 6.8 6 3.1 8.5 12.2 4.9 5.5 3.1 4.7 4.1 7.3 9 4.5 6.6 3.5 6.9 10.9 10.7 14.1 10.8 18.2 6.3 8.6 14.7 19.5 17.3 2 20.4 28.1 22.4 20.1 33.9 22.9 13.7 11 13.4 10.7 8.3 32.6 14.8 11.3 3.4 13.4 11.7 2.2 21.4 12.1 9.1 5.1 13.9 9.1 3.7 12.2 10.6 14.4 17. 15.1 14.1 16 19.2 20.1 10.2 14.3 9.4 10.8 15.3 39 32.1 22.6 10.4 27.6 20.6 6.4 29.1 18.5 9.1 5.7 11.7 8.7 2.9 13.5 12 6.1 4.7 6.6 8.3 6.8 15.2 13.1 10.1 2.2 20.1 12.3 5 19.6 17 24.3 10.7 33 23.2 6.1 29.1 21.4 12.6 8.5 9.8 9.8 4.5 9.8 12 10 6.5 15.5 8.7 4.1 9.8 4.9 9 3.9 12.5 8.2 2.3 17.9 10.2						

Total	473.3 477.7 463.1 443.2 401.3 698.9 675.2

1545

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1908 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0.2 0 0.1 0 0 0 0 0 0 0 1.8 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 3.3 0 0 1.5 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 1.2 0 0 0 0 0 0 0 0 0.3 0 0.4 0.9 0 1 0.1 0 0 0 0.8 2.2 1.5 3.1 5.5 3.1 1.4 2 25.2 10 0 0 0 0 0 5 2 0 0 0 0.4 0 0 2.4 0 0 0 0 0 0 0.3 0 0 0 0 1 0 0 0 0 0 1.3 0 0 8.3 0 0 0 0.4 0.8 0 2 0 0 0 2.9 0 0 18.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0.4 0.3 0.5 0.1 0 0 9.3 6.4 12.1 9.3 3.5 3.6 5.2 1.7 9.8 0.9 4.6 14.3 20 12 7 17.4 0.5 1.5 6.9 0 4.5 0 0 0.3 0 0.8 17.1 6.9 2.8 3.3 0 0 1.2 0 0.3							

Total	25.7 48.4 17.2 23 34.3 76.3 77.6

1546

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1908 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1547

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1909 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1548

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1909 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	6.3	18	0	0	7.1	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0.1	0	0.1	0.2	0	0
20	0	0	0	0	0	0	0
21	0	0					
22 23 24 25 26 27 28 29 30							

Total	7.3 20.6 0.1 0.2 8.1 0 0

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1909 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0.2 0 0 2.8 1 5.7 4.4 11.4 1.9 5.9 1 0.3 1.3 2.7 0.7 10.4 16. 29.4 19.3 28.2 17 7.5 25 14.9 3.1 0.1 3.5 3.6 0.2 18.4 10.2 15.6 9 14.1 9.7 4 58.1 21.8 42.2 6.6 42 33.6 5.1 81.5 31.2 22.4 6.7 26 23.2 6.2 44.6 22.3 48.6 50.8 37.4 39.3 36.1 31.2 27.8 65.7 27.8 88.3 65.2 20.7 107.4 56.4 34.4 24.2 39.9 33.2 19.2 65.6 44.4 4 6. 3.6 4 5 9.1 10.2 0.5 1.3 0 1.3 1.3 4.3 8.9 2.2 2.6 3.3 4.1 3.1 13.7 1 3.2 4.8 1.2 1.5 4.1 5.9 3.2 4.5 3.9 5.2 4.2 2.1 26 14.5 11.8 2.1 20 12.8 1.4 9.1 8.5 8 5.7 10.2 6.1 3.4 15.3 7.7 2.5 1.2 4.2 2.2 0.4 4.4 2.9 4 3.5 4.2 2.9 1.7 2.8 1.4 3.1 2.7 3.7 3 2.1 4.9 2 23.7 3.2 33.8 22.6 2.7 22 15.1 33.9 4.2 41.6 35.8 2.9 47 23.5 40.1 9.7 56.8 37.8 5.6 63.5 27.7 32.7 9.9 38.6 29.3 7.5 18.9 16.2 79.5 22 100.8 73.4 12.7 72.9 34.9 56.8 48.9 54.2 49.3 41.7 114.7 87.5 15.2 30.7 6.3 13.3 24.9 22.1 29.9 22.7 21.7 23.4 22.1 18.5 47.9 42.7 62.9 29.2 78.5 62.8 22.9 89.4 62						

Total	676.5 360.7 776 620.4 275.3 1038 665.5

1550

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1909 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	73.3	49.6	85.6	68	32.5	101.7	62.1
14	2.4	3.6	2	3.5	4.4	14.1	13.9
15	1.3	20.9	10.2	12.6	2.7	14.4	9.7
16	7.7	2.8	1	3	2.6	1	4.1
17	11.4	5	0.4	0.2	0.5	0.6	0
18	0.6	1.2	0.7	1.3	0.8	0	0
19	0	0	0	0	2.5	0	8.7
20	0.6	0	0	0.2	3.4	1.4	5.8
21	5.7	4.4	4.4	4	3.9	2.8	6.4
22	21.5	19.9	1	20.3	8.9	1.2	1.3
23	1.2	13.9	4.8	1.2	1.1	0.8	1.2
24	1.1	1.1	1.9	1.4	1.3	2.5	1.1
25							
26							
27							
28							
29							
30							
31							

4.6	1.9	3.8	1.9	5.6	3.6	1.1	11.9	5.6	0.7	0.4
0	0	0	0	0	0	0.2	0	0.1	0.9	0.3	0	0	0	0	0	0	0	0
11.4	1.8	2	13.2	5.5	0.7	0.6	1	1.1	1.3	0.3	0.3	0
4.9	6.2	2	4.6	1.8	2.5	1	4.3	2.2	0.4	17.4
7.2	8.4	8.3	6.8	6.1	14.5	12	17.2	1.9
1.1	0.9	0.6	30.3	12.9	4.8	2.1	5.9	5.3
1.2	0.7	1.6	0.2	5.1	4.2	5	8.2	2.3	7.7	26.8
3.9	1	4.7	4	0.5	18.2	8.1

Total	199.2 128.9 223.7 195.1 91 383.3 241.2

1551

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1909 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 4.1 0 8.3 4.2 0 2.8 1.7 2.8 5.5 2.8 3.1 7.7 1 2.3 0.5 6 0.1 12.3 23.7 0.5 48 1 16.5 0.3 8.4 33.2 17.3 10.6 0.3 4.9 0 2.4 9. 0 0.9 0.3 5 0 1.3 7.2 0 0.5 0 0.4 0 3.2 2.5 0.1 19 0 0 0 0 0 0.6 0.6 4.7 16.4 0 3.2 16.6 0.9 1.6 0.6 3.9 0 3.3 8 1 9.4 0 0 0.3 1.2 0 16.8 15 0 0 0 0 0 0.7 0.3 0 0 0 0 0 0 0 0.2 0 0 0 0 2.2 6.3 0 0.2 3.1 0 0.5 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.7 0 5 6 0 23.4						

Total	17 68 11.8 47.8 118.7 41.7 133.3

1552

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1909 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1553

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1910 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1554

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1910 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.8 0						

Total	0 0 0 0 1.8 0 0

1555

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1910 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 7.5 0 6.3 5.9 0 2.2 0.9 7.6 0.6 7.5 5.7 0.2 14 2.3 5.4 (7.5 5.6 0 15.9 7.2 3 1.1 4.8 3.3 1.2 14.9 4.7 11 2.8 10.5 11.9 1.6 9 7.4 18.6 9 16.2 14.8 4.8 24.6 11.1 53 6.8 66.2 55.7 4.7 38.4 24 20 2.9 30.8 19.5 2.8 25 11.7 47.1 1 59.2 49.5 1.4 34.2 13.1 16 1.2 15 18 2.5 20.3 6.9 31.8 1.3 41.3 33.3 1.3 19.5 9.8 31.2 3.4 44.6 34.6 2.3 22.8 14.2 23.6 8.8 17.8 20.1 6.6 13.8 5.8 6.6 4.2 6.7 4.7 1.8 3 2.2 8.3 0.2 7.8 5.3 0 5.6 2.8 6 0.1 8.1 4.5 0 9.3 3.9 22.1 0.7 23.8 21.5 0.2 8.3 3.7 128.1 3.8 168.9 124.1 1.3 92.9 31.9 61.8 3 64.5 55.6 2.3 44.1 22 59.1 14.7 78.7 60.3 11.9 47.5 27.2 54.8 46.1 46.9 42.8 26.1 81.9 39.4 78.6 35.9 101.4 79.4 30.3 115.1 68.4 61.2 46. 61.9 61 38.5 66.3 47.3 40.2 44.5 36.4 38.7 36.7 45.8 54.3 27.2 35.2 29.3 28.3 32 25.1 50.1 40.9 35.8 39.1 42 34.5 72.3 73.7 19.8 25.9 22.7 23.8 28.4 52 53.7 45.5 36.5 45.6 44.8 32.7 70.2 53.9 40.3 32.1 41.9 43.9 37.9 104 75						

Total	976.8 404.4 1111.4 958.6 344 1098.4 728.6

1556

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1910 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	25.7	38.4	16.9	22.2	36	45.2	47.6
13	7.7	14.6	5.8	6.6	11.3	12.1	15.1
14	65.1	8.7	24.3	62	31.9	72.2	25.6
15	43.1	11.9	18.9	35.1	28.7	49.9	33.3
16	35.3	10.6	22.2	43.1	46.6	63.8	8.4
17	21.5	14.7	21	23.3	62.4	51.7	27.2
18	9.4	10.6	5.2	19.2	25	8	13.3
19	10.7	12.6	7.6	8	5.5	6.6	4.4
20	3.8	1.4	1.5	1.5	3.3	5.7	2.5
21	0.1	3.1	2.1	12.9	37.5	7.6	16.3
22	3.2	2.9	4.1	3	2.2	1.9	5.8
23	0.9	10.1	9.1	8.4	2.5	7.2	7.9
24	2.2	0.2	0.2	1.6	4.6	1.5	2.3
25	3	4.9	3.9	3.8	5.6	13.4	6.4
26							
27							
28							
29							
30							
31							

Total	320.2 527.5 228.1 314.8 481.4 516.1 648.3

1557

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1910 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	13.8	20.1	11.1	17.4	28	19.8	31.6
15	1.8	3.3	1.3	0.9	0	0.3	0
16	0	2	6.5	0	1.3	6.8	0
17	18.9	9.2	9.7	26.5	0.4	1.5	11
18	0	0.6	0.3	0	0	0	0
19	0.2	0.6	0	0	1.1	0	0.5
20	0	0	0	0	0	0	0
21	6.3	19.6	0.5	2.1	12.8	3.9	9
22	3.4	4.1	0	3.4	0	3.4	11.6
23	2.5						
24 25 26 27 28 29 30 31							

14	7	16	2.2	3.4	7.3	1	9.6
15	0	0	0.3	0.5	0	0	0
16	2.2	3.2	6.7	0.7	8.3	1.6	2
17	7	0	0	0	0	0	0
18	0	0	0	1.8	0.7	0	0
19	2	0	0	0.8	0	0	0
20	0	0	0	0	0	0	0
21	2.8	3.9	2.5	3.2	5.9	4	4.5
22	0.7	1.3	0	0	0	0	0.1

14	1.3	2.4	1.6				
15	0	0	0.7	0.4	0.6	1	0.1
16	0	2.8	2.3	3.(			
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0.5	0	0	0	0	
20	3.2	3.9	2	1.4	1.3	0.8	
21	4.5	4.5	14.8	0	1	7	
22	0.2	0	0.4	2.7	0	1.1	5

Total	58.9 137.9 27.8 46 118.1 65.9 94

1558

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1910 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1559

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1560

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0.9 0.2 1.2 3.1 0 0.3 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0						
20	0.3 0 0 0 1.5 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	0.2 2.8 0.2 1.2 3.8 0 0.3

1561

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.3 8.1 0 5.8 22 0 2.2 0 5.1 0 0 4.6 0						
13	0.5 0.3 0 0.2 0.4 0 0 0 0.4 0 0 0 0 0 0 18.1 9.7 22.9 17.3 4 11.6 12						
14	49.6 24.5 59.3 58 26.7 88.5 56.6 139.3 29.6 184.1 151.4 26.3						
15	149.7 90.2 29.8 23.5 33.9 25.9 17.1 33.9 21.9 49.2 68.7 33.1 41.1						
16	47.1 34.1 57.9 26.8 30 27.9 26.7 24.1 38.3 48.5 35.7 49.7 32.9						
17	42.1 48 41.2 74.7 65.5 37.5 70.9 63.4 28 74.7 55.2 22.6 19.4 22.4						
18	24.2 19.7 29.3 28.1 8.8 13.4 6.8 11.4 15.1 13.5 22.5 9.9 20.5 9.4						
19	23.3 41.1 72.7 74.1 38.4 13.3 53.1 39.4 10.5 38.9 27.6 25.1 30.3						
20	20.1 26 25 47.5 38.1 3.8 8.5 0.7 3.1 6.9 3.2 7.9 4.1 5.7 3.7 3.4 3.6						
21	7.1 5.5 15.1 8 16.8 14 4.3 13 11.2 3.1 0.6 4.3 2.7 0.2 2.7 1.4 1.2 1						
22	1.3 1 0.6 3.5 2.7 0.2 0 0.2 0.4 0 0.1 0.5 3.6 0 5.4 3.3 0 4 2 5.3 0 5						
23	4.4 0.4 9.2 5.1 0 0.2 0 0 0 1.4 0 0 0 0.2 0 0 9.2 3.6 0.8 0 0.3 0.4 0						
24	1.9 0.3						
25 26 27 28 29 30							

Total	557 407.8 615.3 589.1 375.3 729.4 650.9

1562

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	2.2 5.9 0.4 1.9 4.5 3.6 6.4 8.5 5.9 7.2 6.3 3 11.7 6 5.3 6.1 5.7 3.9 2.4 10.3 9.8 6.3 1 10 6.2 0.5 5.7 4.8 3.7 3.7 2.1 2.2 1.5 0.4 0.5 4.9 2.4 4.5 7.5 5.5 7.2 5.3 42.8 31 51 41.2 24.5 50 49.8 27 19.4 31.2 26 13.1 28.1 23.8 11.5 10.2 10.5 7.9 6.4 12.3 12.9 7.6 16.9 4.4 4.4 8.6 5.7 12.5 10.7 18.1 11.8 12.7 20.6 6.9 19.4 25.7 47 12.3 22.9 39.2 38.1 43.9 11.7 10.2 11.4 11.8 6.8 5.8 13.3 9.2 10.2 5.6 8 6.6 12.1 16.3 7.4 6.1 3.7 6.6 8.7 12 20.3 61.1 67.2 63.4 57 57.1 70.8 74.1 7.9 16.5 1.7 5.8 17.6 13.3 16.6 28.7 35.3 20.3 22.5 26.7 21.4 33.7 6.1 9.9 4.4 8.3 10.7 23.4 24.6 4 4.5 3.3 4.9 5.2 12.4 12 11.7 4.2 16.3 13.9 6.2 18.9 11.1 21.5 20.7 20.1 17.3 11.5 8.3 11 4.5 9.9 1.2 5 8.1 9.2 21.4 1.4 1.7 0.1 1.6 2.3 2.5 7.9 2.9 6 2.3 2.9 7.5 1.4 6.3 5 7.3 3.2 2 3.5 3.2 2 5.8 4.7 5.1 5.1 2.3 6.9 1.9 5.9 2.2 5.7 6.1 0.9 5.7 2.3 8 4.3 7.1 8.4 1.7 18.7 11.1 39 34.1 45.4 36.8 20.9 43.7 47.2 17.1 25.8 13.9 14.8 18.9 18.4 33.6						

Total	415.1 448.4 385.3 381.9 353 488.1 561.8

1563

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	1.8 5.9 0 0.9 5.8 0 2.5 7.6 21.5 0 0 8.5 0 0 0 0.4 0 0 0.2 0 0 0 0.3 (
15	0.5 0.2 0 3 1.5 7.4 0 4.7 11.9 0.5 24.2 0.5 6.5 0 3.8 14.9 1.1 10.8 (
16	0 0 0 0.3 0 0 1.1 0 0.9 1.5 0 0 0 0 0 0 1.6 0 0 10.7 0 0 0 1.6 1 4.3
17	12.3 3.8 10.4 0 0 4.1 0.2 0.4 0 0 0 0 0.2 1.8 0 0.4 3.2 0.3 3.7 9.6
18	1.8 5.7 0.1 1.4 0 1.5 2.2 0 6.8 6.4 17.7 2.7 3.5 12.5 6.4 3.7 7.9 6.3
19	12.5 7.9 2.9 18.2 10.5 10.6 17 3.7 4.6 8.1 17.4 5.7 2.4 5.4 0.4 1.2
20	2.2 4.6 5 0.5 2.8 0.1 2.9 5.5 7.4 12.6 4.8 14.8 3.2 12.5 27.6 9.8
21	28.9 1.6 4.8 0.2 0 1.9 7.5 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
23	0 0 0 0 0 0 0 0 0 0 0 0 0 0
24 25 26 27 28 29 30 31							

Total	51 125.8 24 52.4 119.6 81 143.3

1564

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1911 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	8.5 29.4 0 4.3 26.1 0 2.2 0.8 3.1 0.1 3.4 7.2 3.9 12 0 2.9 0 0 19.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	9.3 32.5 0.1 10.6 33.3 3.9 33.3

1565

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1912 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1566

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1912 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.1 14.8 0 0. 7.1 0 0.1 0 1 0 0 0.6 0 0 0 1.1 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0.9 0 0 0.4 0 0 0 0.2 0 0 0 0 0 0 0 0 0.4 0 0 2.7 0 2.6 0 0 1.8 0 0 0.9 2.6 0 2 1 0 12.9 27 27.3 35.9 27.2 30 11.7 9 0 0 0 0 0 0 0 0 0 0 0.3 0 0 2.2 1 3.8 0 1.8 3.6 0 7.8 0.8 2 0 0 0.9 0 0 0 0 0 0 0 0 0 5.7 15.1 4.2 4.9 16.4 1.4 1.9 0 0.8 0 0.8 2.6 0 0.3 0.7 7.3 0 8.1 17.8 0 23.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	41.5 79.6 40.1 45.8 82.9 13.1 60.8

1567

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1912 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0.9 0 1 3.6 0 0.4 0 0.2 0 0.2 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1						
13	0.4 2.3 1.7 1.4 0.8 0.6 0 0 0 0 0.2 0 0 0 0.5 0 0 0 0 0 0.1 0 0 0 0 0						
14	36.9 1.9 56.3 36.6 0.7 16.6 10 0.7 0 0.6 0.9 0 0 0 9.7 14.6 6.4 5.4						
15	6.9 29.8 11.3 34.5 1.2 47 36.7 0.4 23.4 9.9 80.1 15.1 110.2 86.4 9						
16	137.5 64 16.7 5.7 21.3 14.6 2.6 29.3 12.5 11.1 3.3 14.8 9.9 2 17.6						
17	9.7 5.1 2.1 3.2 4 0.9 9.9 14.2 36.1 28.3 33.9 29 20.7 51.8 33.6 24						
18	24.1 21.5 26.3 19.3 77.1 54.4 79.6 40.1 97.3 81.5 24.5 96 68.1						
19	60.6 40.9 79.8 63.2 29.5 46 53.7 60.2 30.3 82.3 65 34.3 160.6 92						
20	68.5 13.3 94.6 71.1 5.9 88.9 47 58.3 10.2 80.2 58 4.6 67.2 29.4						
21	14.8 13.7 10.6 11.8 11.2 33.6 19.3 72.9 16.1 98.2 79.8 10.1 96.4						
22	52.2 48.2 17.1 64.2 43.9 6.7 49.7 24.4 30.5 11 36.5 28.5 9 52.1						
23	16.8 21.9 15.1 27.8 17 7.3 65.7 23.2 62.3 5.5 85.2 58.8 2.4 58.7						
24	26.5 12.8 7.5 15.7 15.5 9.5 54.7 34.4						
25 26 27 28 29 30							

Total	846.9 319.1 1089.9 846.8 223.8 1263.4 708.4

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1912 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	5.6	17.3	2	14.4	29.1	13.2	36.9
13	144	51	55.1	100.3	88.5	98.4	32.7
14	34.9	51.4	31.4	33.3	42.3	32.9	49.1
15	36.3	11.8	12.4	14	13.6	12.5	20.8
16	14.4	40.1	52.9	36.8	37.4	42.1	55.4
17	37.3	41.1	10.6	11.2	9.3	11.6	9.5
18	7.6	2.7	9.7	5.3	0.8	3.8	3.3
19	7.6	12.7	21.6	21.1	9.7	24.4	3.6
20	9.9	21	29.1	23	18.3	15.3	17.3
21	12.7	15.4	6.1	9.5	10	2.4	14.9
22	8.8	5.5	2	9.5	3.8	4.7	5.6
23	4.8	12.1	5.9	14.1	12.6	4	9.1
24	10.2	8.6	7.9	11.6	6.4	8.5	4
25	5.8	7	5.7	8.1	5.2	5.7	6.9
26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
12	46	18.3	40.5	74.8			
13	25.4	35.1	47.3	31.3	69.1		
14	8.9	14.6	19.8	15.3			
15	12.1	13.2	11.7	8.7	6.6	23.7	
16	29	29.1	31.9	32.3	29.6		
17	28	25.5	3	5.1	2.1	3.3	5.7
18	10.5	5.7	1	4.6	4.9	7.3	12.1
19	24.9	12	35.4	20.2	11.7	24	23.
20	23.9	16.2	13.3	9.4	14.3	10	3.6
21	13.2	4	1.1	6.6	3.7	0.4	6.9
22	5.6	6.6	10	20	20.7	3.3	1.8
23	6.7	5.3	5.6	6.4	7	12.1	5.5
24	13.1	10.1	7	11.1	9.6	9.1	4
25	6.9	12	9.3	10.7	15.9	7.8	8.8
26 27 28 29 30 31							

Total	460.8 598.3 418.1 449.3 522.1 609 722.6

1569

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1912 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	2 4.4 0 0.2 1.7 0 1.4 0 0 0 0.8 0 0 5.6 1 0.6 0.1 1.4 1 2.2 8.7 5.9 3						
15	10.8 10.1 12.1 6.8 5.4 0.2 4.8 0.2 1.8 7 0 3 2 0.2 4.1 2.1 0 1.4 1.1						
16	1.5 8.1 1.1 3.5 10.8 0.4 5.8 2.7 8.4 0 0.4 4.4 0 0.1 0 0 0.4 0.3 0						
17	18.1 9.4 0 0 0 0 0 0 0 0.3 5 0.2 5.7 12.7 6.8 20.9 0 0 0 0 0 0 0 7.8						
18	12.5 3.6 3 7.6 1.3 1.2 0.6 1.8 0 0 0.7 0.2 0.3 7.3 10.5 7.5 8.7 11.8						
19	1.7 2.2 0 0 0 4.1 0 0 27.3 0.9 5.1 0.2 2.6 10 1.7 0.9 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8.5 12.6 3.4 5.						
21	9.4 1.7 5.8 15 24.5 14.9 12.8 20.3 16.4 7.8 4.7 14.4 0.2 0.2 6.4 5.						
22	1.9 0 0 0 0 0 0.2 0 2.5 4.6 1.7 1.5 5.6 18.6 10.7 6.7 5.3 5.7 4.1 2.1						
23	9.7 5.7 1 0 2.1 1 0 0.7 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	70.6 126.2 56.2 69.4 123.6 93.5 125.6

1570

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1912 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1571

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1913 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.2 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0.2 0 0 0.1 0 0

1572

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1913 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0.2	0	0	0	0	0	0
19	0.5	0	0	0	0	0	0
20	0.2	0	0	0	0	0	1.3
21	0	0	0	0	0	0	2
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	1.7	0	3.6	1.8
18	0.2	0	0	0	0	0	0
19	0.5	0	0	0	0	0	0
20	0.2	0	0	0	0	1.3	4.4
21	0	0	0	0	0	2	5.7

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0.4	1.2	0.7	0.3	1.2	0	0.4
18	0	0	0	0	0	1.9	0
19	0	0	0	0	0	0.2	0.8
20	0	1	4.3	0	0.3	0	0
21	0	0.8	3.1	0	5.6	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.2	0	0.2	1.3	0	0	0
21	0	0	0	0	0	0	0

Total	5.5 13.1 3.6 4.2 14.2 1.2 6.8

1573

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1913 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	11 0.7 12.2 8.7 3.3 3.6 2.4 9.4 27.2 0.7 1.5 11.7 0 0.1 3.4 10.1 1.1 12.2 0.3 1.1 1.3 0 2.4 1.2 0 0.8 0.5 14.8 9.1 8.8 9.9 8.9 3.8 2.3 110.4 5.9 148 119.1 5.5 99.5 39.8 68.3 26.5 86.5 63.9 15.4 82.1 38.3 70.3 67.7 66.8 66.6 48.6 108.7 95.8 28.9 43.8 20.9 36.2 43.7 54.5 84.5 20.6 32.8 19.3 27.2 40 39.2 73.9 20.5 13.1 21.5 22.8 9. 15 24.6 8.2 16.9 5.2 11.3 18 10.7 27.3 13.2 30.8 10.1 17.8 36.1 38.7 54.2 11.8 10 7.5 9.9 6.5 8 12.7 32.2 3.8 44 33.5 3.5 23.7 11.4 24.8 0.9 36.3 24.8 0.2 31.2 11.6 8.7 2.8 9 10.9 5 37.6 11.9 20.3 0. 24.8 20.6 1 19.9 9.8 7.3 5.9 3.8 6.1 2.4 9.2 5.7 3.9 0 7.9 4 0 2.8 1 0 0 0 0 0 0 0 1 0.2 1.1 0.6 0 0.5 0.2 17.4 3.4 22.3 17.1 3 15 5.7 22.2 16.6 24.3 21.4 12.2 39.2 22.4 15.3 15.3 18.7 12.8 12.1 11.2 9.8 16.9 13.9 20.8 17.3 13.9 29.5 22.5 29.5 39.8 29.4 32.4 34.5 35.9 65.5 74.4 59.5 89.1 80.4 61.4 111.2 74.2 47.1 29.2 52.4 39.9 17.3 45 25.2 30.5 7.8 43.6 29.1 5.3 30.4 18.2						

Total	743.6 494.5 838.5 750 430.8 907.2 753.2

1574

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1913 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.5	29.6	6.5	12	24.1	10.5	35.9
13	16.9	36.7	12.4	15.5	29.3	17.5	37.6
14	36.4	10.4	17.5	9.1	11	19.4	13
15	7.6	19.5	3.3	8.4	18.5	14.9	22.2
16	4.7	9.9	2.2	6.5	13.2	3.3	6.7
17	0.9	0.3	0.2	1.5	3.6	0.3	0.4
18	0.1	0.1	0.3	4.9	2.1	0	0
19	0.4	0.7	0	0	0	11.5	1.1
20	25.9	14.2	15.1	1.5	17.1	15.1	0.7
21	11	27.1	3.6	40.7	23.6	1.7	23.2
22	55.1	14.3	36.4	6.2	14	28	38.4
23	3.5	3.3	5.1	3.3	18.4	13.4	12.1
24	10.3	4.1	17.5	15.5	3.6	1.3	3.6
25	1.7						
26							
27							
28							
29							
30							
31							

Total	289.1 372.7 258.1 284.2 322.1 387 479.2

1575

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1913 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0.5 0 0.3 3 1 0.5 1.5 3.6 0 0 1.4 0.5 0 9 19.9 0.1 0 7.9 6.1 2.1						
15	10.2 0 20.3 10.6 0.4 6.8 4.1 0.2 0 0.2 0.3 0 0 0 0 0 0 0 0 0.2 0 14.						
16	0.3 22.4 15.1 0 6.4 3.9 16.3 11.4 22 13.8 5.5 20.4 8.6 64.4 26.2						
17	69.3 62.6 11.8 29.8 15.5 18.4 1.6 20.5 19.2 1.8 12.2 5.9 8.7 2.1						
18	10.3 10.1 5.7 2.8 2.1 24.5 17.7 18.8 17.8 7.5 7.7 3.9 25.4 23.3 32						
19	17.7 11 14.3 8.6 19.7 11.9 8.8 23.8 36.7 18.3 17 1.3 1.3 0.6 1.8 0.						
20	0.1 5.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0.1 0.2 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	214.4 119.8 226.1 193.3 93.4 126.6 77.6

1576

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1913 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1577

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1914 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1578

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1914 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0.6 0.9 0.4 1.3 3 0.6 0.5 0 0 0 0.1 0 0 0.8 9.5						
20	21.5 5 5.9 17.5 1.5 4.9 0.7 2.5 0 0 2.8 0 0 0 0 0 0.7 1.5 0 4.5 0 0.1						
21	0 0 0 0 0 0 1.1 0 0 0.5 0 0 1.1 4.7 0 0.1 2.3 0 0						
22 23 24 25 26 27 28 29 30							

Total	11.9 30.8 5.4 8.1 27.6 2.1 10.7

1579

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1914 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 40.7 12.8 60.7 37.1 5.3						
13	19.5 11.9 37.7 21.4 40.2 35.6 8.9 58.4 18.9 3 0.4 2.3 2.5 0.8 1.4 0						
14	0.4 0 0.7 0.4 0 1.6 0.5 0 0 0 0 0 1.3 0.4 2.6 0.5 4 3.1 1.3 5.3 2.2						
15	10.6 12 10.7 5.4 4.8 10.5 4.7 7.5 1 4.7 5.7 0.3 1.5 0.3 2.9 0 5.5 3.						
16	0 3.9 1.4 5.3 1.2 4.9 5.9 3.7 3.6 1.4 13.8 3.4 11.8 10.6 1.7 45.1 17						
17	116.7 18.2 151.5 121.2 10.1 59.6 39 23.7 3.3 25.4 25.5 5.4 58.5						
18	47.9 28.4 15.9 31.9 28 10.5 40.3 20.6 68.9 15.2 96.2 71.8 11.7 73						
19	56.4 42.8 9.3 62.5 42.5 5.5 61.2 27.2 31.3 8.1 51.2 31.3 6.7 44						
20	23.6 46.2 8.2 49.9 50.3 6.1 51.9 24.8 25 19.6 27 25.2 11.9 53.6						
21	49.5 22.1 23.4 12.4 13.1 15.6 30.1 26.9 6.1 2.2 9.1 5.5 1.9 11.2 6.						
22	28.5 5.9 26.3 26.4 3.5 23.1 6.3 54.8 5.8 87.7 49.8 3.4 61.3 30.6						
23	77.3 85.2 70.5 59.9 47 42.9 40.1 11.4 19.3 12.3 17 32.8 35.1 37.1						
24	7.1 14.2 3 10.7 21.6 8.2 15 4.3 5.5 4.4 3.9 3.9 5.5 8.7						
25 26 27 28 29 30							

Total	719.1 312 866.8 691.5 224.4 812 519.8

1580

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1914 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	27.1	39.7	24.3	24.9	33.6	58	50.2
12	23.2	3.6	15.2	33.4	13.2	47.7	9.5
13	125.8	35.3	84.5	228.1	30.5	140.4	58.1
14	170.2	73	52.3	88.5	72.2	46.6	94.7
15	71.4	55.6	8.8	4.9	4.7	8.6	9.6
16	6.9	8.3	9.1	6.3	6.1	5.4	10.3
17	39.8	7.4	52	38.3	9.4	39.8	23
18	2.4	25	23.3	3.9	37.9	16.5	3
19	4	2.1	21.3	12.1	29.2	17.2	6.7
20	31.6	27.5	12.4	30.9	24.2	5.4	50.6
21	38.6	23.3	14.1	31.7	23.5	9.6	43.8
22	44.4	55.9	32.8	76.9	55.8	25.4	94.8
23	29.1	46.6	29.5	12.6	38.4	27.7	8.1
24	14.7	10.4	16.8	5.9	23	18.7	5
25	2.4	1.9	2.8	3.3	1.7	5.2	0.6
26							
27							
28							
29							
30							
31							

Total	823.9 754.6 889.6 871.8 841.7 1139 1081

1581

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1914 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	3.4 12.5 0.4 0.9 6.8 0.1 0.3 0.4 2.6 0 1.6 5.9 0.5 0.8 9.4 0.4 16.8 10.7 1.3 18.6 8.7 0 0.5 0 0.1 1.2 0 0.9 3.5 2.4 6.6 6.1 6.8 6.6 9.1 1.6 1.6 2.8 2.2 1.8 19.7 7.7 4.8 0.2 7.4 5.6 0 18 7.6 2.8 0 3.9 2.7 0 1.8 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.4 0.2 0 0.1 1.3 4.7 0.2 2.7 9 0 0.9 5.4 0 0 0 0 0 0 1.2 3.5 0 0 1.5 0 0 0 0.4 0 0 4.8 0 0.1 0.4 0.2 0.6 0.5 0.1 0.1 0 0.1 0 0.1 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	34.5 29 39.2 33.9 39.2 65.5 37.1

1582

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1914 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0.3	0	0.3	1.2	0	0.1	0
17	0.5	0	1.1	0.6	0	0.4	0.2
18	6.8	3.4	1.6	1.5	8.2	0	7.1
19	0	0.3	0	0	0	0	0.4
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23							
24							
25							
26							
27							
28							
29							
30							
31							

15	0	0	0	0	0	0	0
16	0	0	0	0	0	8.7	0
17	4.3	4.8	0.9	1.2	2.9	16.5	8.3
18	17.4	2.8	23.5	0	0.4	0	0.2
19	0	0	0	0	0	0.2	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

15	0	0	0	0	0	0	0
16	3.9	5.6	0	0.2	0		
17	3.8	0.2	4.1	4.7			
18	0	0.8	0	0	0	0	0
19	0	1.2	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22							

Total	18.8 13.9 10 19.9 29.5 23.3 35.3

1583

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1915 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1584

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1915 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.3 7.8 0 0 3.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0.9 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 1 0 2 0.2 4 3.1 0.7 1.1 0.7 1 5.3 0 2 7.9 0 0.9 0 2.5 0 1.9 6.9 0.3 1 5.8 17.5 0 1.6 11.4 0 1.7 0 0 0 0 0.3 0 0 0 0.2 0 0 0.1 0 0 5.9 16.8 0 0 6.7 0 0 0 0 0 0 0 0 0 4 0 4.2 15.4 0 1.6 12.3 28 4 4.3 11.1 9.3 11 7.5 15.3 2.8 3.5 6.1 1.5 9.4						

Total	37.7 97.6 10.8 20.7 69.8 14.1 27.2

1585

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1915 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.2 0 0.2 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 29.1 83.2 0.1 0.6 34 0 0.4 0 0.2 0 0.3 0.4 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.2 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0.4 0 0.3 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 6.9 0 7.6 3.8 0 3.8 2 138.7 0.7 169.9 132.8 1.9 57.7 28.9 24.1 11.1 29.3 23.7 7.4 34.2 27.4 49.3 9.8 63.8 54 5.3 40.7 22 26 20.8 28 26.5 14.1 92.5 74.7 51 24.9 69.3 57.8 31.9 65.8 40.1 37.5 16.6 39.4 35.4 9.6 42 28.2 31 1.8 40.2 33 0.8 16.6 11.7 58.1 5.2 86.1 52.3 3.2 60.3 30.5 66.5 48 73.5 63.9 29.9 104.6 54.9 91.3 93.1 77.1 82.6 84.7 127.1 102.9 56.9 43.1 52.1 68 34.4 103.8 130.2 59.5 38.6 74 69.1 40.8 103.6 97 48.6 28.9 58.7 54.6 26.1 77.8 82.9 52 33.4 59.4 56.7 27.8 74.2 68						

Total	827 460.3 928.7 815.6 354.2 1004.7 803

1586

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1915 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	23.8 42.6 17.7 22 39 25.1 40.2 20.4 44.8 11.1 22.7 42.9 24.5 51.8 12.2 25.1 9.2 12.8 23.9 14.8 29.8 16.7 21.9 15.7 16 14.4 18.3 36 18.6 33.2 13 19.4 32.6 46.7 48.7 12.4 17.3 11.9 12.3 12.3 31.7 35 3.9 6.6 2 2.9 3.3 7.4 8.7 3.7 4.6 4 3.6 3.1 5.7 3.9 6.2 4.8 7.8 8.4 5 7.6 12.1 8.5 12 5.9 7.5 7.2 1.1 2.4 2.6 4.7 2 1.7 2.4 2 2 0.9 1.1 0.7 0.6 0.8 0.6 0.9 0.8 2.1 0 0 0.9 0.7 0 2.2 0 2.6 2.7 0 0.5 0.3 0.7 0 0 0.6 0 0.4 0 1.7 0 2.5 1.9 0 2 0.9 4.2 0.6 6.4 4.5 0.2 4.7 2.3 0.7 2.6 0.4 3.4 0.4 0.3 0.7 0.4 0.6 1.3 0 0.1 2.4 0.6 0.2 0 0.2 0.7 0 0 0 0.2 0 0 0 0 4.1 0.4 6.9 4.3 1.3 4.2 1.8 5.3 0 8.7 4.9 0 7.9 3.1 10 1.9 9. 9.7 1.9 24 13.8 37.6 15.2 41.6 33.2 7.9 24.9 19.5 31.3 14.2 30.3 30.5 6.9 17 12.6 26 4.6 45.8 27 3.8 17.7 17.4 31.7 5.9 58 33.1 6.7 27.3 21.7 40 1.7 75.6 41.4 1.4 30.9 22 24.9 7.8 32.9 24.1 6 15.7 9.8 16.1 6.4 26.1 16.8 8.8 24.7 18.2						

Total	368.5 282.9 449.1 366.5 237.1 388.6 418.3

1587

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1915 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	12.6	18.9	3.5	7.7	18.5	5.3	7.6
15	3.5	3.6	2.4	3.5	2.2	7.7	3.6
16	8.9	6.9	0.9	1.1	0.3	1.4	0.9
17	1.9	1.8	3.6	8.5	4.3	31.7	0.2
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0.4	0	0	0	4.2	1.2	6.3
22	0	0.6	2.5	0	0.2	2.7	8.8
23	0	0	0	0.3	0	0	0
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	14.9	3.3	18.3	13.3	4.1	8	6.7
15	10.5	8.1	2.6	5.1	5.2	3.5	8.2
16	4.3	6.4	0.8	3	0.3	1.3	2.8
17	0.2	44.8	36.3	0.9	33.2	13.3	0.1
18	0	0	0	3.6	0	6.3	3.9
19	0	0	0	0	0	0	0.1
20	0	0.7	3	0	0.7	0.2	4.5
21	0.1	6.3	18.6	0.1	0.3	8.3	6.3
22	1.6	9.6	0.9	5.5	2.8	7.4	0.4
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	6.5	6.2					
15	1.6	2.5	4.4				
16	15.9	8.5	1.6	2			
17	0.1	0	0.1	0.2	0		
18	1.2	0	0	0	0	0	0
19	0	0.1	0	0.4	0	0	0
20	14.1	35.1	0				
21	0	1.8	0	0	1.4	0	0
22	0.6	2.5	0.3	0	0		
23	0	0	0	0	0	0	0

Total	95.9 91.2 92.2 90.3 76.7 120.7 107.6

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1915 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 1.2 5.5 0 2.2 11.2 0 1.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (0 0 0 0 0 0 0						

Total	1.2 5.5 0 2.2 11.2 0 1.6

1589

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1916 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1590

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1916 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0.8 0 0 0.9 0 0 0 1.1 0 2.1 4 0 6.5 0 8.2 0 4.1 18.2 0 2.3 0 0 0 0 0 (						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0 0 1 0.5 0.2 0 0 0 0 0 0 0 0.3 2						
18	0 1.6 5.4 0 2 1.7 0 3.6 1.8 0.3 1.2 0.7 13.4 31.8 2.8 6.6 14.6 0 9.3						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	15.4 45.9 6.4 16.2 44.4 1.7 21

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1916 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	20.1	1.7	18.5	22.4	2.5	9.8	10.1
12	24.7	36.4	28.7	10.7	16.3	10.9	69.4
13	13.9	116.6	66.3	5.7	121.1	44.8	37.4
14	19.8	117.9	88.5	20	128.4	94.1	32.5
15	15.1	15.2	15.4	6.6	47.3	19.7	20.3
16	44.6	39.7	19.6	110.8	58.3	10	11.4
17	6.3	7	18.3	5.8	23	20	5
18	20.3	18.9	15	14.7	17.5	23.2	26.9
19	30.9	27.3	25.9	20.9	62.6	35.9	41.6
20	75.8	10.6	98.3	79.1	4.8	45.8	23.6
21	22.7	19.9	25.6	22.5	15.6	35.5	42.4
22	47	31.7	70.7	19	20.6	43.1	84.9
23	51.4	27.5	35	16	21.4	25.9	39.4
24	10	8	6.7	8.8	3.4	9.8	12.2
25	3.5	1.9	3.2	5.3			
26							
27							
28							
29							
30							

Total	963.7 607.6 1071.9 901.8 394.6 1343.7 953.3

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1916 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	29.3	64.5	19.2	24.8	53.5	56.4	61.8 70.5 82.4 64.1 53.9 41.4 106.2
13	71.8	45.1	33.8	46.7	50	34.3	109.2 78.7 80.5 45.2 95.3 79.8 36.2
14	123.6	97.2	45.5	42.1	39.4	44.9	38.8 59.2 62.3 24.5 33.6 28 28.4
15	32.4	49.8	64.5	12.7	19.7	11.2	10.3 13 39.6 32.8 18 21.6 9.9 9.1 9.
16	39.8	25.3	20.1	8	18.7	19.8	4.3 14.8 15.1 2.8 1.5 2.8 3.4 1.1 6.2 5.
17	8.6	6	10	7.9	4.5	5.5	4.6 11.2 12.1 8.1 8.7 7.9 3.8 7.9 4.1 11.4 1 4.
18	9.7	2.9	17	7	18.4	2.4	7 13.9 10.1 26.1 8.9 12.6 8.9 8.5 7.3 15 24.8
19	7.3	20.6	3.9	12	25.3	15.3	34.8 6.6 14.6 2.4 6.8 14.6 13.7 14.4 9.2
20	7.4	9.9	7.8	7.3	24.1	13.2	5.6 3 6.7 4.9 2.3 9.5 5.8 2.5 1.3 2 2 1.1
21	2.1	1.9	9.4	8.5	8.9	8.3	3.9 13.2 12.6 5.7 12.6 2.9 5.3 7.6 58.4 40.7
22	2.2	3.4	0.3	1.1	1.7	1.5	4.4 0.4 1.3 0 0.4 1.2 1.6 1.7 0.1 0.4 0 0 0.1
23	0.6	0	0.7	0.5	1.2	0.7	0.7 5 2.1 1.6 0 3.2 1.6 0 1.7 0.9 2.8 0 4.7 3 0
24	8.7	1.8	2.6	0.7	4.1	5.1	2.7 26.2 17.1 0.1 0 0.1 0.2 0 0.6 0 0 2.3 0
25	0.3	1.5	0	2.1			
26 27 28 29 30 31							

Total	445.6 489.5 416 420.1 377.7 824.3 748.6

1593

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1916 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	2.3 0 0.4 0.7 0 0 0 1.6 4.4 0 0 1.7 0 0 0 0.5 0 0 0 0.1 0 0.4 0 0.3 0 0 2.2 0.4 0 0 0 0 0 0 0 3.4 0 5.7 3.9 0 1.8 1 0.6 0 0.5 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0.2 0 4.3 2.8 0 27.1 1.5 5.4 1.5 6.2 0 2.6 0 0.7 0 0.2 1.2 0.7 0.9 0.6 2.3 0 0.4 1.1 3.5 3.9 13 38.3 2.4 8 26 16.6 26.7 7.8 23.8 2.1 5.8 23.9 9.4 4.9 1.1 1.1 1.7 2 3.8 32.6 14.9 3.8 6.3 1.2 0.9 3.6 1.2 0.5 28.4 60.7 19.2 20.3 42.4 20.6 25 6.3 28.1 0.6 9.2 34.9 11.2 16.9 0.7 1.1 0 0 0.5 0 0 0 0 0 0 0 0 25 0.1 37.4 28.9 0.3 11.8 6.1 7.9 0.2 9.4 8.9 1 4.2 2.1 10 26.8 1.4 0.6 11.4 11.8 2.9 0.3 0.2 0 0 0.3 0 0 0 0 0 0 0 1.4 0 0.1 0 0 0 0 0 2.1 0 2.8 2.5 0 19.7 4.5 13.6 6.3 15.5 9.1 7.4 12.4 7.5 10.2 6.4 11.6 7.4 6.7 3.8 4.4						

Total	140.7 213.3 112.2 116.3 175.2 165 152.3

1594

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1916 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1595

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1917 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	1.3	0	0	0.9	2.5	1
15	10.2	10	11.3	12.4	13.3	7.9	13
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0			
21 22 23 24 25 26 27 28							

Total	30.6 25.5 28.7 28.8 19.9 20.2 21.6

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1917 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	1.2
16	0	2.4	0	1.6	6.2	0	0.6
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	1.2	0.5	0	0.7	0
21	0.5	11.3	0	0.2	0	0	0
22 23 24 25 26 27 28 29 30							

Total	10.7 35.9 0 4.4 28.3 2.3 7.3

1597

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1917 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	0.8	3.5	0.3	3.6	9.9	0	2.6
12	8.3	1	1.6	0.8	2.7	4.6	5.7
13	29.8	25.7	14.3	35.5	21.8	49.4	16.8
14	10.7	7.8	1.7	11.1	6.2	9.2	6.9
15	10.7	43.3	44.2	105.3	46.3	123.9	103.5
16	36.6	37.5	35.6	50.8	39.2	47.6	41.7
17	32.2	63.4	57.3	39.6	49.4	47.6	36.9
18	24.9	5.5	39.3	24.4	4.1	28.8	22.4
19	32.9	6	43.9	32.8	4.1	51.8	29.4
20	2.4	0.3	2.4	2.6	4.6	12.9	1
21	5.9	49.4	66.9	16.3	24.2	11.1	15.2
22	10	4.6	9.9	14.5	4.5	7.6	9.2
23	46.2	38.7	44.5	46.4	42.8	122.7	96.8
24	75.3	22.5	56.9	7.7	20.8	43.7	29.2
25	13.8						
26							
27							
28							
29							
30							

Total	706.9 483.7 726.6 691.9 401.8 1014.6 927.7

1598

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1917 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	4.1	6.5	3.5	3.3	3.7	13.6	10.6 3.5 6.8 2.9 2.3 4.6 5.9 5.5 3.3 3.4 2.3
13	3.2	4	2.5	3.2	3.1	2	2.1 2.3 2.1 6.5 4.4 4 2.1 5 4 1.2 8.5 3.2 2.2 1.5
14	1.7	1.4	1	9.8	3.1	14	2.8 24.9 13.5 2.3 19.5 12.5 11.9 7 10.4 10.8 4
15	22.4	10.2	12.7	17.3	10.4	9.3	8.9 42.6 25 17.1 19.9 19 15.4 19.5
16	34.8	27.8	6.8	2.7	8.9	7.6	2.2 16.5 14.1 14.3 2.9 19.7 15.7 1.7 12.5
17	7.1	42.4	1.9	83.1	43.3	1.1	33.2 26.3 4.5 4.3 3.5 3.5 2 12.5 4.9 12.(
18	3.9	13.4	12.3	1.9	19.6	8.4	5 0.6 4.6 6 0.4 4.5 1.3 1.2 0 2.2 1.2 0 1
19	0.6	1.5	2.5	1.2	0.6	1	5.3 2.2 7.3 4.1 9.8 7 2.8 6.2 2.7 7.9 2.4 8.2 4
20	1.2	11.8	6.7	31.8	2.3	20.1	28.2 1.2 11.7 4.7 58.8 22.3 78.8 54.1
21	10.4	54	23.8	47	20.9	46.3	42 12.6 47.8 28.8 15.1 2.9 19.8 15.7 2.3
22	21.5	13.1	15.7	7.9	21.6	15.8	5.1 19.7 12.9 24.6 14.8 29.8 23.7 10
23	18.9	23.6	7.5	9.9	5.5	10.3	11.6 14.6 21.5 18.7 18.1 18.2 16.5 9.9
24	19.7	24.7	48.1	29	59.1	53.9	25.9 55.1 67.1 50.5 36.8 49.4 51.6
25	37.6	93.4	79.6	41.7	19.1	66.8	47.8 31.6 104.5 66.4
26							
27							
28							
29							
30							
31							

Total	538.9 278.6 652.2 527.2 224.6 750.3 546

1599

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1917 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	33.2 21.5 38.8 30.1 15.5 42.3 34.8 14.5 11.4 9.6 13.4 9.3 34.1 26. 5.2 2.4 7.6 4.4 1.6 7.3 3.7 3.2 4.4 1.5 2.1 2.2 3.8 2.1 4.1 3.3 3.9 2 1.5 3.5 2.5 0.8 1.8 0.2 0.5 1.2 4.7 3.1 22.6 3.7 37.5 23.8 2.2 24.4 10.6 13.3 11.2 14 10.5 5.2 6.7 4.2 2.2 1.4 1.8 2 0.6 0.4 0.2 0 0 0 0 0 0 2.5 0 0 0 0 0 0 0 1.6 4.1 1.1 2.1 5.4 0.6 2.9 8.7 19 6.9 8 19.5 18.4 8.7 9.5 16.9 4.7 9.2 14.5 17.2 29 9.7 0.5 12.1 10.2 0.1 5.2 4. 11.5 1.4 10.9 14.1 0.6 6 3.8 11.5 38.2 0.2 2.8 24.8 10.1 5.7 19.6 58.3 4.6 11.6 46.5 26.1 29.5 20.1 33.6 12.5 11.8 18.8 12.9 11.7 8. 0 10.6 7.3 1.1 8.3 4.1 7.8 4 12.1 7.5 2.6 5.4 5 17.1 24.5 9.1 17.3 2 27.1 29.6 22 10.9 30.3 22.9 15.1 21.5 28.4 8.4 1.9 10.6 9.2 1.4 6. 2.9 14.4 5.9 14 12.5 5.4 13.7 9 6.4 2.6 8.2 7.2 2.1 18.2 10.3 7.8 1 12.7 9.8 1.9 22.1 15.5 1.8 0.1 0.4 0.5 0.4 3.2 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	285.8 284.7 275.9 253.6 226.5 349.4 291.9

1600

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1917 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1601

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1918 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1602

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1918 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0.7
19	0	0.5	0	0	0	0.8	0
20	1.5	5.2	0	2.1	9.7	0	7.3
21	0	0.9	2.9	0	0	1.1	0
22							
23							
24							
25							
26							
27							
28							
29							
30							

Total	7.3 27.3 1.1 3.3 20.5 0.4 10.6

1603

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1918 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	5.5 3.8 4.8 5.1 5.7 7.5 8.4 23 3.7 31 26.5 5.6 29.6 17.1 3.4 5.1 1.9 2.6 4.5 13 7.6 5.9 1.8 11.1 6 1.3 9.6 5.2 0.2 0 0.4 0.2 0 1.5 0.6 0 0 0 0 0.4 0 3.1 9.1 0.3 0.4 4.9 18.5 7.3 3.2 1.9 3.9 3.3 1.9 4.1 1.8 22.9 3.5 26.4 24 1.3 23.4 7.9 0.3 0.2 0.4 0.2 0 0.1 0 0.4 0 0.4 0.6 0 0 1.6 0 3.2 1.6 0 1.1 0.7 0.4 0 0 0 0 0 0 5.2 0.6 7 4.8 0.2 8.9 2.9 7.8 9.4 1.7 2.6 8.7 1.1 1.1 3 0.6 4.2 2.7 0.5 1.7 0.8 10.5 3.5 13.4 11.6 0.8 6 2.8 70.3 24.3 75.9 61.2 12.2 58.2 34.8 78.3 24 95.3 80. 14.1 127.8 67.5 15.7 20.1 14.1 16.8 18.4 49.5 40.7 45 15.2 56.7 43.1 8.7 66.9 31.4 13.9 8.8 16.5 13.6 7.7 15.9 13.2 7.7 12.9 4.5 5 7.8 13 14.9 2.8 5.8 1.5 3.2 3.4 9.2 16.8 0.3 0.4 0 0.4 0.6 2.2 2.6 2 1.3 0.8 1.6 1.8 0.4 3.5 1.5 0.4 1 1.6 0.2 1.5 0.5 0.9 0 0 0 0 0.5 0 2 5 3.7 2.2 3.4 1.2 1.5 3.8 2.1 2.6 4.2 0.8 0 0						

Total	341.6 163.5 382.7 326.6 114.5 472.8 291.6

1604

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1918 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	21.2	17.8	25.1	19.2	10.7	34.6	28.4
13	19.2	16.1	20.5	20.4	10.6	28.4	24.1
14	48.1	18.7	9.1	26.1	19.6	8.3	30.7
15	25	17.6	12.8	11.2	11.6	6.6	17.7
16	7.7	8.2	2.3	15.9	6.2	13.5	3.5
17	2.2	26.6	13.4	0.8	0.9	0.9	1
18	13.5	10.4	13.2	6	7.9	7	2.8
19	11.5	18.5	27.7	23.7	15.1	47.4	3.1
20	11.7	13	25.2	59.3	46.9	27.8	40.2
21	12.1	15.9	10.7	25	33.3	8.8	17.7
22	3.5	10.9	11.4	13.9	18.3	11.1	26.4
23	5.3	16.7	15.2	15.2	15.8	12.8	12.1
24	10.5	7.1	0.9	0.1	0.9	0.8	0
25	0.9	11.1	11.2	10.8	7.2	4.9	15.4
26							
27							
28							
29							
30							
31							

Total	381.9 414.8 359.2 351.7 294.5 621.2 615

1605

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1918 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0.2 0 0 1.5 8 22.5 0 0.6 9.4 0 3.9						
16	1 5.9 0.1 0.9 5.7 0 0.3 4.4 13.2 0 0.1 5.3 1.2 0.5 0.8 1.5 1.1 0.3 0.4						
17	18.4 4 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0.5						
18	1.4 0 2.7 0.6 0 17.6 4.2 11.3 0 1 6.7 0 1.7 0 0.1 0 0 0 0.1 0 0 0.4 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2						
20	0 0 15.6 3.4 10.7 0.3 1.6 8.5 6.4 2.5 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23 24 25 26 27 28 29 30 31							

Total	22.5 67.4 1.5 9.8 36.6 27.1 47.6

1606

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1918 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.6 2.8 0 1 2.5 0 4 0						

Total	0.6 2.8 0 1 2.5 0 4

1607

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1919 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 0 0 0.3 0 0

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1919 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1 2.7 0 0 1.1 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.3 0 0 1.4 5.2 0 1.5 7 0 2.3						
Total	2.4 8.4 0 1.5 10.5 0 2.3						

1609

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1919 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1.3 0.6 1.5 1.3 0.2 0.4 0.2 1.8 0.3 1.6 2 0.4 0.2 0.1 1.3 0 1.4 0.9 0 1.8 0.2 32.7 14.7 41.8 37.7 16.8 41.1 26.5 12.5 5.9 7.4 16.5 9.9 0 18.2 20 8.3 23.6 20.7 4 64.6 26 35.2 4.8 41 38.4 11.2 61.5 32.4 35.9 13.7 40.9 35 8.8 93.7 31.8 43 19.3 47.2 39 8.6 43.6 20.5 11.8 8 8.3 9.2 3.6 21.9 9.7 19.7 4.6 23.4 21.1 2.4 12.7 7.2 15.2 4.3 12. 10.5 2.4 11.2 5.3 4.6 6.6 3.4 5.1 3.4 3.6 10.6 27.1 11.3 35.1 37.8 7.1 31 73.8 48.4 82 33.2 50 89 45.1 46.5 5.6 12.8 3.8 6.5 18 10.5 6.9 0.9 1.4 1 1.1 1.1 0.5 1.2 1.6 5.2 0.3 6.7 3.2 1.3 39.2 17.3 45.2 8.5 23.6 40.7 8.6 67.6 42 128.1 7.3 14.1 78.3 17.9 18.4 15.4 41.5 1.6 2.4 19.8 7.2 5.1 6.8 0.3 9.1 8.2 0.6 13.9 8.6 18.3 10.8 17.9 16 5.9 12.1 9 12.2 4.6 13.4 11.9 4.3 17.9 10.1 51.5 3.8 69.3 53.4 2.6 52.6 22.6 31.8 3.1 35.6 33 3.5 31.2 9.7 5 1.6 3.2 3.3 0.9 8.5 5.7 17.6 17.7 13.6 11.3 7.8 31.6 22.3 24 15.3 25.2 19.8 9.4 26.8 18.6 53.7 13.5 73.1 54.9 7.4 55.6 50.5						

Total	614.2 489.3 605.2 591.5 371.3 728.8 604.5

1610

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1919 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	30.8	33.9	26.4	26.4	19.8	53.8	53.8
12	53.5	32.4	36.6	20.5	21.7	24.4	34.9
13	28.9	35.7	20.4	10.9	23.5	23.9	15.5
14	11.7	12.2	12.2	10.8	11.3	11.3	7.2
15	27.6	22.9	22.4	21.5	25	18.5	12.9
16	10.4	4.2	9.6	0.8	4.6	5.2	4.6
17	0.7	2	3.4	1.9	7.5	8.5	10.3
18	14.1	4.2	4.2	2.1	2.9	3.2	5.7
19	5.4	5.3	12.7	6.5	11.8	5	13.5
20	16.5	10.6	16.3	3.4	16	15.5	2.3
21	9.9	2.1	5.5	1.3	4.6	7.2	14.3
22	22.4	28.5	26.5	20.7	55.5	49.2	61.7
23	37.6	11.4	44.7	37.6	8.6	28.7	13.4
24	5.3	2.3	14.8	11.9	4.2	5.7	1
25	8.2						
26							
27							
28							
29							
30							
31							

Total	488.8 382.5 477.6 471.3 268.5 618 594.8

1611

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1919 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	14.9 2.6 23.6 18.3 2.2 23.6 27.2 5.3 1.8 8.3 7.8 1.7 23.3 21.6 9.2 6.1 9.2 9.2 3.7 32.8 15.9 7.4 10.4 6.2 5.2 7.1 7.5 3.1 1.3 0.6 2.5 1 0.6 0.8 0.5 8.7 3.7 10.9 6.8 3.7 40.4 13.4 25.7 3.4 33.4 23.6 1.7 22.4 7.9 14.2 4.2 18.7 14.4 1.8 10.8 4.9 7.2 11.9 1.5 1.9 6 6.2 5.6 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 6.2 0 0 2 0 0 8.4 20.5 5.9 8.9 24.8 10.9 10.4 22.1 30 21.4 17.2 16 15.2 35.2 2.6 11.9 0 4 17.5 0 2.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 4.2 0 2.8 3.1 0.3 16.6 7.6 21.3 0.9 2.5 11.7 14.4 11.2 1 2.9 0 2.5 3.7 1.2 15.2 2.9 7. 1.9 2.4 6.8 4.9 2.2 2.6 5.6 1.1 1 2.9 0.3 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	144.2 155.3 145.5 130 117.5 215 194

1612

DAILY RALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1919 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 1.1 7.1 0 10.5 8.9 0 7.4 9.1 32.6 7.9 41.6 36.5 10 17.7 9.5 0 0.1 0.1 0 0.1 2.9 0						

Total	39.7 8 52.2 45.6 10.1 28 19.7

1613

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1920 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1614

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1920 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0.3 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0.2 0 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 7.7 21.6 0 0 8.6 0 0 9. 1.9 11.2 10.2 5.8 2.7 1.7 0 0 0 0 0 0 0 6.2 17 0 0 6.6 0 0 9.3 0.6 8 13.5 0.6 0.2 9 9.7 4.7 5.7 5.3 2.5 2.6 1.3 0 0 0 0 0 0 0 0.3 1.8 0 0. 1.5 0 0.1 5 13.3 1.3 3.7 14.1 0.3 1 15.2 16.9 11.9 22.1 23.2 10.2 1 6.7 6.9 8.9 4.7 2.8 2.9 1.8 0.3 3.4 0 1.2 7.2 0 0.5						

Total	70.2 89.2 47 61 73.8 18.9 34.4

1615

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1920 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.5 0 0.4 0.7 0 0 0 0 0 0 0 0.5 0.9 0.3 1.2 2.4 0.3 0.9 1.3 0 2.4 16. 3.8 21.7 12.7 1.1 9.5 4.1 6.8 15.2 2.6 9.8 20.4 0.2 12.4 2 4.7 2 4.2 11.3 10.5 6.2 35.5 28.1 28.3 25.8 17.1 18.3 18.7 64.8 11.8 85.4 69 6.5 68.4 33.2 128.4 47.3 160.7 126.5 25.6 90.1 54.1 26.5 15.2 28 26.9 7.6 14.2 21.7 8.1 7 10.7 18.2 12.3 31 68.1 18.5 35.5 11.3 22. 30.1 43.4 79.2 20.4 28.2 17.2 15.1 21.7 16.2 15 3.6 3 2.5 2.8 1.3 (2.7 9.7 1.9 13 9 1.2 10 6.6 27.6 6.9 38.2 28.6 4.9 40.5 19.8 24.1 2.1 17 19.6 1.3 40.5 22.4 11.6 11 10.5 9.4 5.5 5.1 4.9 14.8 29.8 6. 8.4 14.1 24.3 22.9 6.7 4.6 6.5 8.7 2.2 5.5 28 27.9 32.9 11 18.1 13. 7.4 36.8 23.3 37.6 3.7 11.8 18.5 9.6 51.1 19.3 27.8 17.7 18.7 22.3 23.6 33.1 5.6 11.8 2.4 6.4 13.3 5.9 12.8 10.4 9.5 8.7 9.2 4.5 21.6 15.1 1.8 1.4 2.5 3.8 1 3.8 15.1 21.8 9.6 26 23.6 9.1 42.4 16.3 7.9 1.2 11.8 7.5 1.3 3.6 2.2 4.8 1 6 4.4 0.4 2.9 1 1.3 0.7 1.4 1.4 0.5 1.2 2.8						

Total	551 392 555.2 523.5 270.1 556.6 609

1616

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1920 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	17.9	21.8	14.9	21.1	24.2	31.6	39.8
13	6.4	4.3	9.3	8.7	6.1	17.9	20.4
14	3.3	4.3	2.2	4.8	6	6.8	11.5
15	5.6	4	4.6	2.3	2.4	1.9	6
16	16.3	1.9	16.4	9.6	3.1	4.7	1.6
17	11.8	3.3	5.6	2.1	3	4.3	37.3
18	12.5	8.7	8.7	14.1	11.9	32.6	1.1
19	8.3	4.3	1.6	0	2	2	0
20	3.8	7.2	3	26.6	18.1	25.8	22.6
21	21.7	11.9	22	11.3	21	15.9	5.3
22	60.3	21.6	10.8	5.1	11.9	10.9	3.2
23	2.4	4.9	4.6	1.5	6.9	3.3	4.7
24	11.6	7.2	10.2	2	12.9	9.9	2.3
25							
26							
27							
28							
29							
30							
31							

	23.2	40.4	0.4	23.6	10	6.7	0
	32.3	12.9	2	1.4	2.3	1.7	0.3
	7.5	18.1	8.7	15.6	16.4	16	11.7
	31.3	16.5	39.5	32.2	38.8	30.8	17.4
	20	11.1	3.5	0	4.3	3.6	0
	4.5	5.7	5	14.3	7.8	7.3	5.6
	4.6	5.8	2.7	0.6	5.1	2.6	0.2

	7.7	7.3					
	2.1	0.6	10	5.1	7.5	8	
	18.1	8.7	15.6	16.4	16	11.7	7.2
	39.5	32.2	38.8	30.8	17.4		
	3.6	0	2.7	1.2	4.7		
	7.3	5.6	7.3	5.5			
	2.6	0.2	10.7	3.1			

Total	332.8 259 321 309.9 186.1 504.5 359.7

1617

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1920 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.2 2.8 0.2 4.5 9.1 2.9 12.7 0 3 0 6.2 10.8 0 20.9 6.3 15 1.8 2.2 7. 2 0.6 2 5.6 0.2 1.7 5.7 3.4 3.4 7.9 10.2 5.3 4 8.1 15.7 6.2 7.1 10.2 7.5 7.7 13.8 28.1 10.1 7.3 13.1 3.6 9.2 26.2 9.2 18.8 14.8 31.1 6.1 10 28.6 43.2 34 4 0 7.2 4.3 0.2 2.2 1.4 0.5 0.9 1.1 1 3.8 0.4 0.4 0. 1.1 0 0.4 3.3 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0.2 0.3 0 0 0 0 0 0 0 0 0 0.9 0 1.1 3.9 0 1.4 0 0 0 0 0.2 0 0 0 0.2 0 0.2 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0 0 0 0 0 0 5.5 0.1 8.8 6.2 0 2.4 1.5						

Total	57 94.3 41.8 58.9 122.6 109.5 111.6

1618

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1920 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1619

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1921 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1620

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1921 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0.5 1 0 0.1 0 0 0 0 0 0 0 0 1.2 0 0.2 0.8 0 0 0 0 0 0 0 0 0 1.5 4.4 0 0 2 0 0 0 0 0 0 0 0 0 0 0 1.1 0 0 7.5 5.9 13.9 2.4 1.4 11.7 1.1 0.5 5.2 14. 0.1 0.2 5.1 0.9 0 0.4 1.7 0 0.6 2.6 0 0.2 16 24 13.6 10.3 13.5 4.2 7.6 0 0.3 0 0 0 0 0 0.2 0.5 0.2 1.2 2.2 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 2.3 0 1.7 6 0 0.7 0.4 1.1 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 1.7 0 0.2 3.9 0 0.5 0 0.1 0 0 0 0 0 0 4 0 1.4 11.2 0 0.5 0 0 0 0 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0						

Total	30.6 69.7 16.3 18.9 60.8 6.2 20.9

1621

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1921 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0.5	0	0.4	0.5	0	2	0.8
13	1.2	9.3	0	14.1	8	0	10.9
14	16.5	0	6.5	4.4	5.4	0.3	1.2
15	21.4	7.3	5.9	1.1	7.2	6.2	0.6
16	46.2	8.7	63	47	4.7	57.6	26
17	15.4	50.6	43.3	18.4	48.6	32.2	46.5
18	48.5	12.3	63.7	46.1	5.9	64	26.2
19	8.3	13.3	6.3	8.5	9.5	33.8	27.4
20	56.4	40.9	61.7	66.1	44.8	183.2	118.1
21	144.2	20.4	47.2	9.3	25.7	44	41.5
22	3.2	3	4.5	3	2.7	6.6	4.7
23	0.4	0	0.2	0.3	0	0	0
24	0.7	0	0.5	0.3	0.2	0	0
25							
26							
27							
28							
29							
30							

3.4	0.3	3.6	2.7	3.4	0.1	2.2	1.2	0.1	4.1
3.5	6.8	2.7	5.4	7.1	1.1	7.6	1.4	13.3	0	11.9
0.3	1.2	0.7	0.2	1.2	0.4	33.2	0.5	43.7	38.7	1.7
1.1	7.2	6.2	0.6	9.6	2.9	70.4	9.1	97.1	70.8	5.6	67	33.9
4.7	57.6	26	74	15.5	107.2	76.4	10.7	87.4	48.1	36.1
18.4	48.6	32.2	46.5	13.3	65.2	48.9	9.9	59.9	31.5
5.9	64	26.2	40.4	11.6	46.1	38.1	5.8	70.1	24.5
8.5	9.5	33.8	27.4	11.7	10.2	14.7	10.3	11.4	25.1	15.1
66.1	44.8	183.2	118.1	64.5	73	73.8	76.7	78.8	116.4
9.3	25.7	44	41.5	103.5	3.6	3.5	2.4	3.7	2	12	12.3
2.7	6.6	4.7	0.5	0	0.7	0.4	0	0.3	0.2	1.7	1	0.9	1.1	0.4	0.2
0	0	0	0	0	0	0	0	0	0	2.5	0	4.4	2.8	0	2.1	1.1	0.7	0.1	1.3
0.3	0.2	0	0	0	0.1	0

Total	617.3 282.8 765.2 652.2 258.6 943.3 673.9

1622

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1921 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	19.3	20.6	22	22	18.1	33.9	36
13	49	42.1	18.9	64.3	50.2	13.3	19.5
14	8.9	10	11	9.1	11.9	13.5	8.4
15	16.7	31.4	11.8	13	18.9	37.7	36.5
16	110.8	14.4	30.1	10.7	12.7	23.8	54.3
17	21.1	18.2	26.6	12.3	11	14.8	13.5
18	26.1	10.5	11.9	12.3	14.8	18.5	13.1
19	12.5	3.9	7.1	2.4	3.1	4.7	10.9
20	11.1	8.5	7.7	10.9	9.1	12	27.1
21	8.3	25.3	49.4	55.7	80.2	23.4	18.4
22	14.3	9.7	7.3	11	8.2	7.7	2.3
23	3.9	0.9	1.1	0.3	1.6	1.2	1.3
24	1.5	1.8	3.4	3.5	0.9	0	0.7
25	0	2.3	0.9	5.4	1.7	6.6	6.2
26							
27							
28							
29							
30							
31							

Total	438.4 494.9 394.8 403 376.9 689 669.4

1623

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1921 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 1.8 0 4.7 7.4 0 19.2 0 0 0 3.1 0 0.3 20.6 0 2.4 0 0 1.7 3.3 1.2 0.5 3.6 0 1.6 5.3 1.7 2.8 12.7 36.9 0.1 0 15 6.7 2.7 9.9 24.8 3 3.9 16.3 12.3 5.3 5.2 5.2 0 2.7 11.6 0 3.1 13.5 19.7 8.5 16.9 15.6 40.3 29.8 32.6 57.3 21.8 15.6 34.3 7.4 5.5 30.3 24.4 34 23.4 13.1 18.2 12.7 2.6 0.9 1.6 2.7 2.6 0.4 4.3 0.1 0 0 0.3 0.3 0 1.7 0 4.7 0 3.8 6.1 0 0 0						

Total	112.1 177 72.8 81 123.2 90.6 108.9

1624

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1921 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1625

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1922 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0 0 2.4 0 0 0 0 0 2.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 3.6 0 0 5.1 0 0

1626

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1922 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0.5 0 0 0 0 0 0 0 0 0.3 0.7 0 0 0.3 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0 3.2 9.1 0 0 3.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0 0 0.7 0 0 4.3 3.7 3.2 4.2 2.2 1 0.2 2.6 9.2 0.2 0 8 7.7 2.6 3.2 5.8 0.3 1.1 3 0 4.2 0 1.2 0 0.8 0 0 0.1 0 0 0 0 1 0 2.3 6.7 0 1.1 3.5 0 5.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.9 0 0 1.3 0 0 0 0.3 0 1.7 1.2 0 8.8 0.6 0 0.4 2.3 0 0 11.3 3. 1.5 6.9 5.3 5.4 2.3 2						

Total	20.1 41.5 11 15.7 31 12 34.5

1627

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1922 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	4.5 0 7.8 4.6 0 3.4 1.5 42.9 4.4 60.9 46.6 2.2 37.3 19.7 21.9 0.8 26.7 23.4 1.7 24.6 10.6 7.3 8.4 7.7 3.8 3.2 7 2.7 2.9 0.3 0 0 0 0 0 6.7 0 11.8 7.3 0 3.9 2.2 0.3 0 0 0 0 0 0 0.7 0 1.2 0.7 0 0.4 0.2 4 0.2 7.1 4.4 0 2.9 1.3 4.9 0.3 8.5 5.4 0 13.8 5.4 30.8 2.9 33.6 33.5 1.3 15.2 8.7 42.9 7.6 56.3 41.6 4.6 43.7 27.3 31.1 3.9 37.5 31.5 1.8 31.8 14.7 93 5.3 152.5 101.1 4.7 73.3 44.6 102 15.2 116.5 103.2 9.4 52.2 28.2 20.9 14.9 16.5 13 7.5 24.2 15.1 6 0 7 6.8 0 7.4 2.5 2.2 0 4.4 2.1 0 30.6 13.2 19.6 0.8 17.1 18.8 0.5 12.2 3.4 45 6.7 61 47.5 3.1 37.8 20.6 29.5 1.8 50.1 30.7 0.6 23.3 11.2 13 7 5.8 5.6 3. 32.3 16.9 29.2 6.4 34.8 31.6 4.4 29.1 15.5 57.2 16.9 70.5 54.4 7.8 95.5 44.1 45.6 20.4 53.4 44 12.9 85 50.9 35.4 31.1 38.2 28.6 25.3 41 43 24.8 30.4 28.2 28.5 31.2 40.2 57.9 26.2 63.4 8.7 17.8 37.2 22.6 59.2 13.7 22.2 9.3 20 24.2 21.4 55.4 64.7 94.9 66.4 62.7 83. 134.9 143.2						

Total	828.9 366.2 999.5 819.2 271.3 947 719.2

1628

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1922 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	11 34.8 1.8 13.1 36.7 33.3 55.4 8.8 21.1 3.7 12.6 20.3 8.9 33.4 6.5						
13	17.9 3.5 5.6 12.6 10.2 16.4 3.9 10.2 1.6 3.3 7.8 3.3 8.7 6.9 8 5.7						
14	5.3 5.7 6.2 7.9 6.8 8.1 7 7.2 8.4 7.9 8.2 11 10.5 10 11 7.9 8.5 7.4						
15	6.3 3.1 6.9 5.9 2.3 5.3 4.6 2.1 3.2 1 2.2 2.6 4.6 3.6 1 2 0.8 0.6 1.3						
16	0.9 1.2 1.3 3.2 0 1.3 4 4.2 4.7 4.6 5.1 3.5 3.5 2.7 5.3 5.8 4.1 5.7 2						
17	3.3 3 4.1 5.4 5.5 6.1 2.9 4.6 4.6 8.5 14.4 3 5 1.2 1.5 2.7 7 7.7 16						
18	12.3 17.8 14.9 6.5 26.3 27.7 41.9 17.7 55.9 40.9 9.9 71.2 45.5 16						
19	11.4 15.8 14.8 5.8 19.6 20.5 37.9 25.3 51.8 33.7 12.5 45.5 36.7						
20	22.8 47.7 8.3 14.2 27.2 11.9 43 17.8 34.8 7.6 14.3 21.5 18.4 32.5						
21	10.9 14 9.7 9.8 9.5 13.8 23.2 12.2 22.8 6.2 9 13.6 24.5 26.2 11.5						
22	2.9 14.8 12.3 1.9 15.8 8.3 8 5.3 8.9 6.9 3.5 13.8 10.1 4.1 3.6 5.1						
23	3.3 1.6 1.6 1.5 8.8 2.7 12.9 8.7 1.4 39 15.8 7.3 3.8 8.8 6.9 1.8 9.2						
24	4.9 8.1 4.2 8.1 8.6 3 10.9 3.6 19.8 23.9 17.8 12.5 11.8 29.6 14.5						
25	17.8 7.1 26.9 17.5 4.4 27.2 15.8						
26 27 28 29 30 31							

Total	343.8 383.5 328.5 309.3 258.5 496.5 514.6

1629

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1922 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 2.1 7.6 0 0 3.6 0.2 0 4.8 14.9 0 0.4 7.6 5.9 2.2 1.1 4. 0 0.9 4.4 0 0.3 0 0 0 0 3.1 0 0 0.2 0 0.4 0.2 0 0.1 0 0.2 1.3 0 1.3 2 0.3 8.3 3.7 9.6 0.9 1.1 5.5 2.8 0.3 2.2 0.9 0.3 0.3 0.9 15.2 7.9 4.8 15.2 0 0.8 9 0.4 0.4 2.3 10.3 0.5 3.7 12 0.5 8.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0.7 0.4 0 0.3 0.2 0 3.9 0 2.8 4.6 0 13.1 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7.8 8.7 6.1 3.3 4.4 9.2 4.2 0 1.8 0 0 1.3 0 0 2 0 3 2.7 0.4 4.3 1.7 0.3 0.1 0.7 0.8 0 2.2						

Total	33.3 79.3 12 18.6 60.2 37.9 51.8

1630

DAILY RALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1922 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1631

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1923 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.3 0 0						

Total	0 0 0 0 0.3 0 0

1632

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1923 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	3.6	10.8	0	1	6.7	2.3	2.7
16	0.1	1.5	0	0.9	0	0	0
17	0	0	0	0.8	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	4 21.7 0 5 23.9 2.3 11.9

1633

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1923 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	0 0 0 0 0.3 0 0 10.2 11.3 5.1 8.4 5.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
14	0.6 0 0.1 0.4 0 0 0 0 0 0 0 0 0 0.3 0 0.6 0.3 0 0.2 0.1 0.4 2.1 0.3 0						
15	1.4 0 0 1.1 0 0.9 1.5 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 1.1 0 65.6 26						
16	77.9 66.9 19.5 40.5 27.5 58.3 27.1 63.9 53.2 21.1 75.3 43.3 38.8						
17	29.4 48.4 31.2 15.4 45.8 30 3.4 0 2.7 4.4 0 1.4 0.4 3.7 0.5 4.4 3 0						
18	24.6 10.2 4 3.3 3.4 2.8 1.3 7.5 3 3.9 0 7.6 5.8 0 3.4 15.1 49.9 5.3						
19	61.2 51.1 2.9 33.3 20.6 50.3 9.8 69.2 46.8 5.5 58.8 23.8 23.7 13.9						
20	22.1 19 6.8 11.7 4.3 3.8 6 3.2 2.5 3 3.4 3.6 24.8 68 4.7 13.2 39.8						
21	25.9 55.1 6.7 15.1 2.8 2.3 6.2 1.3 5.6 1.3 0.2 2.7 1.4 0.2 1.2 0.9 1						
22	0 1.3 2 0 5 2 8.4 4.6 9 5.9 2.3 5.3 2.1 9 1 7.6 5.9 0.4 12 5.3 11.5 1						
23	15.8 12.4 0.6 33.8 12 41.1 1.5 53.5 47 2 35.3 14.9						
24 25 26 27 28 29 30							

Total	422.2 227.3 468.3 387.6 134.2 426.8 279.8

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1923 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	37.5 100.8 11.5 31.3 95.2 51.9 61.8 23.9 30.3 27.6 32.2 43.1 35.1 50.2 16.6 11.6 15.5 13.7 9 12.9 10.1 16.7 26.2 14.1 10.2 14.2 15 16.3 36.1 11.6 16.4 32.9 17.8 38.9 15.1 40.7 2.8 11.4 30.5 11.3 32.4 25.3 55.3 5.8 12.6 31.2 35.3 45.9 62.1 68.1 22.9 25.3 31.4 19.9 21.4 34.5 44.5 26.4 21.2 23.4 21 20.3 107.4 82 95.9 93 55.1 72.7 63.3 23.7 30.8 22 20.4 17.9 25.8 36.2 26.2 28.2 34.8 30.6 27.4 33.3 58.9 30.9 65.1 18.4 24.4 54.3 64.4 43.4 24.2 47.1 18.3 24.3 36.5 20.9 55 17.4 32.5 8.5 12.5 23.3 16.1 21.1 11.9 25.1 5.9 15.2 12.3 18.2 8.8 11.9 7.7 8.5 11.8 8 16.3 8.4 11 10 10.1 15.8 9.4 14.2 5.9 20.6 2.3 13 37.8 7.9 14.5 14.9 10.3 14.8 15.7 10 9.1 9.2 10.4 15.5 7.2 8.9 9.9 6.6 18.6 14.1 29.3 8.2 10.5 19.9 12.1 22.8 18.9 30.6 18.6 14.4 25.6 54.6 23.3 5.5 11.2 3.5 4.7 7.6 5.7 11.2 2 4.9 1.2 2.2 3.6 3.4 8.8 11 17.8 9 9.2 11.8 41.4 26.6 7.3 11.6 5.7 7. 10.6 6.3 11.3 5.5 6.9 3.9 5.1 5.6 2.4 5.1 1.6 1.5 1.4 1.8 1.3 4.1 6.3 2.4 0.7 2.9 2.8 0.6 3.5 2.8 3.8 1.1 4.1 4.2 0.5 1.6 1.2						

Total	610.2 909.3 442.5 505.8 713 641.8 781.3

1635

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1923 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0.7	0	0	0.4	0	0
16	0.4	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0.8	0.4	14.4	10.1	0	0.3	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	
23 24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	1.7	0	1.6
16	0	0	0	0	0	0	0.5
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0.1
19	1.4	0	0.1	6.6	0.5	15.5	8.9
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	5.5	0	0.6	0	1.1	0	1.1
16	0	0	0.6	1.9	0	0.2	0
17	0	0	0	0.1	0	0.1	0.4
18	0	0	0	0.1	0	0.1	0.4
19	0.5	15.5	8.9	2.7	7.5	3.9	
20	0	0	0	0	0.3	0	0.8
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	3.8						
16	0						
17	0						
18	0						
19	3.9						
20	0						
21	0						
22							

Total	6.6 5 15.8 13.8 17 22.7 17.3

1636

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1923 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 4.1 0 0 0 0 0 0 1.6 4.6 0 0 1.8 0						

Total	1.6 4.6 0 0.6 1.8 0 4.1

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1924 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1638

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1924 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.6 3.5 0 3 6.2 0 9.9 6.8 5.6 0 7.6 2.2 0 49.9 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0.4 3 0 2 7.1 0 0.8 0 1.2 0 0 0.8 0 0 1.1 4.4 0 1.4 6.1 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 2.6 0 0.5 3 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.9 0 1.6 7.1 0 0.6 0 2.3 0 2.3 4.9 0 7.2 0.3 0 0.2 0.7 0.6 0 2.2 2.3 6.5 0 0 2.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	11.9 31 0.2 19.1 41 0 71.3

1639

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1924 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0.2	0	0	0	0.5	0.2
13	2.4	6.5	3.9	0.3	0	0.4	0.2
14	0	2.1	0.2	2.2	2.2	0.1	0.4
15	25.8	0.2	26.6	28.4	0	8.9	3.7
16	46.9	35.4	0.3	47.1	18.2	20.8	4.5
17	50.8	18.9	53.1	42.9	27.1	5.4	39.6
18	15	5.1	39.3	34.2	85.5	29.5	119.3
19	24.9	12.1	50.9	41.2	69.6	22.8	98.1
20	194.3	166.7	69.5	171.6	136.9	55.8	9.4
21	3.9	39.2	24.7	3	17.2	7.6	2.4
22	0.4	0	0.8	0.9	0	1.1	3.9
23	15.3	1.2	23.2	14.3	0.5	20.6	7.4
24	1.6	1.5	0	0.6	1	1.6	3.5
25 26 27 28 29 30							

Total	752.9 238.3 905.5 742.2 191.1 922.7 588.8

1640

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1924 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	8.1	6.8	9.8	10.2	9.2	16.6	16.8
13	20	17.1	13.8	25.8	20.6	14.1	16.9
14	6.1	10.7	14.1	2.8	19	13.9	10.8
15	12.8	15	15.1	21.8	18.6	8.6	8.2
16	11.1	15.9	16.1	9	7.3	6.2	6.7
17	1.4	1.7	2.1	1.5	3.9	1.7	2.5
18	4.1	1	1.3	0.7	0.9	1.8	9
19	0.8	0.9	1	4.5	3.2	0.4	0.4
20	1.6	2.4	1.3	2	1.5	3.7	1.4
21	10.6	11.7	2.8	6	15.5	17.8	12.1
22	3.9	3	4.6	2.5	7.2	18.6	14.1
23	10.5	16.7	32.3	21.2	6.4	12.5	4.5
24	17.8	16.9	30.5	51.1	74.9	52.3	49.3
25	23.9	29.2	35.4	43.1			
26							
27							
28							
29							
30							
31							

Total	304.2 354.4 283 289 317.1 443.9 467

1641

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1924 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0.6 0 0 0 0 0 0 0 0 0 0.3 0.2 0.2 0 0 7.9 3.3 12.4 8.3 12.3 9.2 3.3 9.6 4.5 7 19 0 0.1 7.9 1 0.4 2.1 7 0 0.3 3.1 0 0.1 0.1 0 0 0 (3.2 1.3 0 0.1 0 0 0 0 0 0 0 0 1.3 1.4 0.9 8.8 2 7.1 0 0.6 6.2 0 1.6 1 2.2 1.9 0.9 0.8 0.6 0.4 0 0 0 0 0 0.8 0.7 0.6 0.6 0 0 0.6 2 0.7 0.4 0 0.4 0.8 0.2 3.7 2.9 0.1 0 0.1 0.2 0 0.8 0.3 0 0 0 2.1 0 0 13.6 0 0 0 0.3 0.5 0 1.7 0 4.9 0 1.9 12.8 0 0.7 8.3 23.6 0 0 9.6 0 0 0 0.5 0 0.6 0.1 0 3.9 0 0 0.1 0 0.2 5.4 2.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	34.5 73.5 15 18.3 47.3 35.9 47.2

1642

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1924 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0						

Total	0 0.4 0 0 0.4 0 0

1643

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1925 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1644

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1925 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0.2 0 0 0 1.9 0 1.9 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0 1 0 0 0.6 0 0.2 4.7 0.2 1.7 10.8 0 0.5 0.5 1.5 0 0 0.6 0 0 0 0.4 0 0 0.7 0 0 16.8 0.7 28.5 19 3.9 8.4 5.2 10.9 0.6 22.2 12.5 6.2 7.6 9.3 0 0.2 0 0 0 0 0 3.7 12.7 0.2 1 8.9 0 0.4 0 0.3 0 0 0 0 0 0.4 1.4 0 0.2 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	32.5 26.4 51.1 34.4 36 16.1 15.9

1645

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1925 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	78	12.7	106.7	72.2	6.8	82.5	40.5 38.3 15.8 42.3 33.5 8.8 32.9 17.
13	21.5	8.6	18	21.3	6.3	37.1	24.4 10.9 5 16.4 13.9 9.6 13.8 13.3 14.2
14	5.3	13.8	19	6.1	27.6	20	66.4 80.7 66.7 57.7 58.7 64.7 58.9 18.1
15	36.1	6.4	11.7	27.4	5.7	15.3	5.8 1.3 5.4 7.6 2.8 1.9 0.7 6.4 0 5.2 8.
16	0	3.9	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0.6 0 0.9 0.7 0 0.5 0.2 1.6 1.9 1
17	0.9	1.4	10.5	2.3	1	0	1.7 1.2 0 17.1 2.6 9.1 2 17.2 8.7 1.3 20.1 10.6
18	3.9	0	7	3.5	0	4.7	2.4 2 0 2.1 1 0 0.9 0.4 27.3 0 29.5 32.1 0 12.1 4.
19	3.2	0	3.5	1.7	0	5.7	2.5 9.1 1.8 5.3 4.4 0.7 6.3 2.5 30.5 17.5 26.5
20	15.8	7.7	37	14.4	49.6	20.5	54.6 47.8 14.6 101.6 38.3 80.9 33.4
21	94.8	80.5	24.4	102	66.6	97.4	87.2 86.3 77.4 55.6 105.3 96.5 91.5
22	76.3	79.7	91	69.4	77	106.2	83.1 88.3 86.9 76.6 58.3 105.6 114.8
23	23.3	34.2	18.4	26.2	30.2	21.6	51.4 16 18 10.4 16.6 17.5 17.3 31.6
24	19.4	43.8	5	14.3	38.3	10.4	31 10.8 24.8 4.2 7.5 17.2 10.4 21.2
25 26 27 28 29 30							

Total	819.9 615.2 816.3 752.9 463.1 936.2 790

1646

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1925 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	5.2	9.3	1.6	1.9	3.7	1.4	4.1
13	3	1.3	1.1	1.4	0.9	0.4	1.7
14	23.2	16.2	3.8	25.4	18.7	6.3	11.9
15	21.1	5.8	40.1	26.5	53.1	9.8	56.4
16	70.1	4.9	71.4	30.9	37.1	13.8	50.9
17	16.6	13	40.2	23.2	13.3	4.7	19.5
18	13	8.3	3.2	1.8	4.2	4.7	1.4
19	12.2	1.5	14.5	8.6	0.7	15.7	7.4
20	5.3	4.1	12.3	15.1	8.4	21.9	3.9
21	31.6	28.3	49	9.3	10.7	5.7	6.2
22	21.7	7.9	10.9	7.4	7.1	9	5.2
23	26.2	18.1	26.8	24.6	8.6	22.7	17.3
24	33	22.6	41.3	28.5	13	26.5	27.3
25	3.9	4.1	7.6	18.9	16.3	10.5	6.3
26							
27							
28							
29							
30							
31							

Total	495.5 341.5 536.9 455.6 222.3 614 574

1647

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1925 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.7 7.6 2.3 7.8 23.2 44.9 21.5 3.2 6.1 2.8 3.5 5.9 16.1 9.2 0.7 0.5 0.1 0 0.6 5.8 1.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0.8 0 0.4 0.6 0.3 10.5 12.8 11.1 8.5 12 10.6 4.1 16.1 31.1 12.4 19.2 25.4 12.2 25.1 0.3 4.5 0 2.7 9.6 4.2 4.1 0.3 0.4 0 1.4 0 0.6 9 0.3 2.5 0.1 3 2.6 4.9 19.2 6.1 16.1 1.8 2.6 8.7 22.2 16.9 14.5 47 1.9 11.4 45.8 12.8 19.3 3.4 14.7 12.9 2.1 3.9 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 1.2 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	74.4 133.3 47.2 73 136.6 128.3 126.2

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1925 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2.9 1 1.8 1.7 0 4.6 17.4 0 3.7 16.5 0 10.2 0 0.2 0						

Total	6.6 20.5 1 5.5 18.2 0 10.2

1649

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1926 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1650

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1926 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0						

Total	0 0 0 0 0 0 0

1651

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1926 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 1.9 5.4 0 0 2.5 0 0 11.1 32.3 0 0 13.8 0 0 13 4.4 18.3 23.4 18.4 17 54.5 2.8 2.9 1.2 2 1.2 7.4 5.1 34.5 1.2 40.2 37.5 0.9 17 6.8 24.8 7.7 23.6 21.3 3.9 28.9 11.7 37.2 5.9 46.3 39.8 4 49.6 25.6 24.7 0.9 41.9 24.1 0.8 29.5 20.3 39.1 2.2 47.4 44.1 2.5 42.3 20.2 37.3 15.6 41.9 35.2 13.6 40.8 21.1 25.4 18.2 16.9 20 28.5 68.5 40.8 36.7 2.5 39.2 37 2.7 33.6 16.3 12.7 1.7 13.8 9.2 1. 10.1 4.9 48.6 1.5 58.9 53.8 0.9 36.1 12.7 19.7 4.2 25.9 17.2 2.4 19.6 8 9.6 0.4 11.1 9.6 1.3 11.6 3.6 0.4 0.4 0.6 0.5 0.1 0.2 1.5 5.2 3.1 5.6 4.5 1.2 1.6 0.8 2.2 0 3.6 1.8 0 3 1.2 0 0.3 0 0.4 1.5 0 1.2 7 22.7 1.6 5.7 22.2 11.9 16.8 27.3 8.6 30.2 25.8 5.4 24.2 17.8 28.2 4.5 38.2 32.7 3.4 29.3 28.6 48.8 4.6 64.5 50.5 5 58.1 36.9						

Total	498.5 151.4 570.9 496.1 137.4 541.2 356.4

1652

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1926 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	23.6 21.6 27.6 20 13.2 30.5 18.7 63.7 11.8 75.8 66.9 8.7 102.4 62 47.6 43.4 51.7 46.5 33 94.7 54.4 117.3 139 88.9 86.8 73.4 116.6 111.8 56.3 113.6 29 35 64 83.4 96.6 67.4 87.5 62 64.7 61.8 92.4 123.8 42.4 85.4 23.1 47.2 84.7 70 133.4 45 80.9 26.5 37.5 63.6 5 78 28 67.4 16 28.3 64.2 38.9 65.6 11.3 30.6 3.9 11.4 30.1 9.3 30. 16.4 29.8 10.1 19.2 30.4 21.1 37.8 10.6 15.3 6 8.8 13.8 15.2 15.5 7.9 7.7 5.6 5.6 5.1 13 8.4 6.8 6.3 7 5.9 4 8.6 7.1 7.9 19.8 1 3.1 12 13.4 14.8 9.6 29.5 2.1 11.3 29.5 15.3 33.4 23.5 49.9 17.2 26.7 53. 33.5 60.3 9.3 16.5 5.7 7.6 12.1 6.1 10.9 4 9.2 1.1 2.4 4.9 2 5.3 5.2 5.3 4.6 3.7 2.6 4 3.2 6.4 3 6 6.7 2.2 8.9 7.6 0.1 0.7 0 1 2.4 3.3 3.5 2.1 2.3 0.9 1.8 4.5 3 3.5 3.5 5 3.2 4.1 6.8 12.5 10.9 4.3 2.1 4.2 5.8 1.7 13.1 12.9 4.1 4.2 4.1 4.8 4.1 29.5 18.5 55.7 23.2 70 58.2 15 58.7 54.5 33.6 23.4 23 26.8 16.9 45.9 36 19.1 8.2 23 20.2 5.6 10. 12.5 14.6 19.1 9.4 12.5 10.7 26.1 20.1 12.9 16.8 8.7 12.1 11.1 16. 22						

Total	760.2 978.5 617.4 692.6 745.6 1052.5 1173.6

1653

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1926 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	7.5	7.2	7	9.2	4.5	13.2	23.1 0.2 0 0.5 0.2 0 7.7 2.8 0.5 0 0 1.3 0 1.2
16	8.3	0	0	0	0.3	0	1.7 2.3 0 0 0 0 0 3.7 1.5 0 0 0 0 0 0.2 0 0 0 0 0 0 0
17	0	0	0	0	0	0	0 0 2.1 0 2.1 7.3 0 0.8 0 0 0 0.4 0 0 2.5 7.8 8.4 7 8.5 8
18	26.3	13.2	3	6.9	1.9	8.1	14.3 6.3 25.3 0.2 0.8 0 0.1 0.9 1.2 0 0 0.3
19	0	0	0	0	0	2.4	0 2.2 8.8 0 0.8 0 0 0 0 0 0 0 0.5 0.1 0 0.1 0.5 0 0 0 0
20	0	0	0	0	0	0.6	1.7 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
21	0	0	0	0	0.3	0	0 0 0.4 0 0 0 0 2.1 5.8 0 0 2.3 0 0 0 0 0 0 0 0 0 0 0
22	0	0.4	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
23							
24							
25							
26							
27							
28							
29							
30							
31							

Total	22.4 36.7 16.4 32.5 48.1 61.5 80.6

1654

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1926 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1655

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1927 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1656

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1927 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.4 0.3 0.5 0.1 0.1 0 0 0 0 0 0 0 0						
16	0.1 0 0.1 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	3.5 12.1 0 0.2 7.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 3.8 11.3 0 1.3 4.3 0 8.4 0 0 0 0 0.2 0 0 0 0.2 0						
21	0.5 1.1 0 2.3 4.4 12.7 0 1.1 8.7 0 4.8 0 0 0 0 0 0 0						
22							
23							
24							
25							
26							
27							
28							
29							
30							

Total	11.9 36.4 0.4 3.5 22.7 0.1 15.6

1657

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1927 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	1.4	1.8	0	0	0.7	0	0
13	0.7	0.6	0.1	0.6	0.5	0	0.6
14	0.8	2	1.2	0.6	0	1.1	0.6
15	0	0.4	0	1.2	0	2.1	1.4
16	1.2	64.5	36.1	0.5	43.7	16.9	29.9
17	57	37.5	41.7	46.8	81.6	42.4	45.4
18	7.6	25.2	3.2	13.5	34.6	79.2	57.1
19	30.1	55.4	26.3	38.2	63.8	41.6	77.6
20	46	9	10.7	8.3	11	12.1	32.9
21	6.8	1.1	7.1	4.8	2.2	0.6	3.2
22	34.6	12.5	39	34.6	6.5	37.9	32.1
23	6.3	22.1	34.8	2.6	15.6	1.8	22.3
24	4.8	3.1	17.8	11.7	7.4	14.5	2.1
25 26 27 28 29 30							

1 2 3 4 5 6 7 8 9 10 11																				
12	0.9	2																		
13	5.1	2																		
14	0	0.1	0																	
15	13.8	36.5																		
16	10.2	52.5																		
17	155.8	69.8																		
18	9.5	35.7																		
19	43.1	27.9																		
20	5.8	1.3	7.																	
21	3.8	7	4.7																	
22	18.4	5.5	32.3																	
23	6.4	6.7	2.(																	
24																				
25 26 27 28 29 30																				

Total	437.7 344.6 402.2 428.6 325.8 731.1 495.6

1658

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1927 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	2.9	0.7	4.1	3.3	0.5	6.6	4.2
13	4	1.3	7.1	3.9	1.1	3.1	1.5
14	19.5	16	26.7	14	5.7	11.7	2.4
15	8.8	3.5	8.8	2	4.4	8.4	1.6
16	10.6	13.4	11.6	15	20.7	40.7	11.5
17	10.2	17.3	26.9	29.4	8.2	7.3	2.4
18	11.7	7.4	9	8	6.8	8.5	7.2
19	3	15	14.1	8.3	7	11.5	8.5
20	8	7.9	3.9	5.7	5.3	14.2	11.3
21	13.5	23.6	26.5	8.4	7.3	8.8	7.5
22	68	65.9	20.6	23.3	18.7	20.4	18.5
23	29.2	20.2	21.9	18.9	18	13.8	11.3
24	16.7	13.9	10.3	7.2	11.5	10.3	5.9
25	15.1	17.8					
26							
27							
28							
29							
30							
31							

Total	301.9 329.2 280.2 278.5 265.7 471.4 459.6

1659

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1927 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	21.1 4.5 29.4 24.9 4.3 76.6 29.9 30.8 16.3 26.7 28.7 9.5 34.4 15.5 16.6 21.2 9.2 10.3 10.2 24.4 14.6 5.6 3.4 7.4 4.9 2 3.6 3.6 8.6 0 14.5 10 0 4.6 6.8 0.4 0.4 0 0 0 0.1 0 0.2 0 0.3 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.3 0 2.9 2.9 0 0.6 1.7 0 2.6 0 0 1.5 0 0 0 0 0 0 0 0 0 0 0 0.4 2.5 0 2.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 1.2 0.5 0 0.2 0 0.2 0.7 0 0 0 0 0.2 0 0 13.3 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	85.6 48.6 90.6 82.5 31.1 158.8 80.3

1660

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1927 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1661

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1928 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 1.5 0.8 0.2 1.3 0.2 0 0.2 18.8 0.9 0. 4.9 0.1 1.3 0						

Total	2.4 20.3 1.7 0.9 6.2 0.3 1.3

1662

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1928 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0.2	0.3	4.8	1.7	0.2	1.9 1.5 19.5 0.5 5.4 5.2 0.3 17.8 0.5 0.7 0.6
16	0.3	1.2	0	0.1	2.5	27.3	1.8 5.7 17.7 0 7.3 0 0 0 0 8.9 0 4.5 0 0 0 0 0
17	0	0	0	10	0.2	0	1.1 0 4.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
18	0	0	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
19	0	0	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
20	0	0	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
21	8.7	0	0	0	0.6	0	0 4.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9
22 23 24 25 26 27 28 29 30							

Total	4.5 58.3 3.4 16.2 48.7 0.5 36.8

1663

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1928 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.9 0 0 0 0 0 0 3.6 0.3 7.1 0 0 11.1 1 20 30.3 12.3 21.7 22.3 73 19.1 61.6 63.2 82 69.9 60.7 103.6 62.8 40 37.2 41.8 59.4 43.4 125.1 89.3 54.5 44.1 39.8 60 49.7 71.3 83.1 37.8 15.1 22.9 36.6 23.7 25.6 18.8 21.5 16.4 14.4 12.7 13.1 38.9 10 30.6 22.8 66.4 8.4 17.1 76.4 15.8 82.2 65.5 48.2 10.6 39.3 64.4 28.9 19.5 27.3 7.2 5.6 17.4 41 16.9 48.1 67.9 31 39.6 48 85.3 58.(51.7 49.5 75.1 6.6 30.8 31.4 25.3 10.6 9.6 16.4 2 8 11.2 4.5 2.1 0. 0.1 0.1 0.8 1.1 2.7 4.2 2.7 0.7 34.5 13 12.5 16.5 20.3 6.8 17.7 28. 13.3 37.5 20 11.9 8.5 43.9 5.1 7.3 22.8 6.9 4.9 3.6 17.2 4.7 4.3 19 7.8 11.3 8.1 7.3 13.4 10.2 17 8.9 33.1 18.9 10.8 24.8 19.6 32.6 15 42.7 27.7 42.3 34.6 29.6 25.8 23.2 11.9 10.1 30.6 21.1 12.8 19.2 13.8 18.1 11.8 31.5 10.1 11.2 39.6 16.8 6.3 4.6 27.1 11.8 7.3 8.6 6.2 0 0 2.9 1.2 0.4 2.7 0.7 9.7 7.1 0 7.5 8.3 2 3 2.8 1.9 0 0.5 1.8 0 0.3						

Total	663.2 561.5 696.7 530.6 513.4 1000 576.2

1664

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1928 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	18.3	29.3	12.1	17.1	28.4	23.1	34.7
12	16.8	12.5	17.4	23	12.8	12.7	23
13	30.9	22.3	15.4	19.1	16.7	16.5	16.3
14	16.1	13.3	15.5	18	14.4	8.3	11.6
15	17.9	9.1	4.2	27.3	16.1	18.1	16.8
16	76.2	49.1	46	49.7	41.5	44.8	27.1
17	29.5	22.9	18.3	23	23.9	16	17.9
18	36.8	20.6	14.1	45.5	26.2	34	33.4
19	35.8	16.6	12.2	26.8	15.2	26.6	18.5
20	20.2	34.5	12.9	14.9	32.4	19.7	16
21	45.7	8.3	11.6	50	20.6	69.7	31.9
22	9.8	9.2	1.2	16.8	9	4.2	10.5
23	3.8	95.2	49.3	50.3	64.1	80.1	84.9
24	84.9	113.8	47.2	53.8	73.2	45.5	48.3
25	25.5	29.5	26.5	24.4	28.7	51.6	38.6
26	23.6	34.2	33	18.4	11.7	21.3	21.4
27							
28							
29							
30							
31							

Total	1031 798 729.6 1122.5 815.8 935.3 878.2

1665

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1928 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	42.4 31.6 85 6.8 28.2 50.1 22.4 4.1 5 32.3 24.9 9.7 20.1 12.5 5.8						
14	4.8 0.5 0.5 3.6 13.5 3.9 2 0.3 0.2 1.6 0.4 1.6 0.7 15 0.8 4.9 7.4 2.3						
15	4 2.8 13.1 3.9 24 9.4 3.7 22.8 7.6 8 6.9 63.6 2.7 6 17.9 1.9 0.7 1						
16	5.1 0 0.5 3.1 0 1.2 2.2 0 0.1 5.4 0.3 13.2 0.2 0 0 0 0 0 0 0.1 0 0 1.(						
17	0.6 0 0.6 3.5 1.3 0 0.2 1.2 0 0 12.9 3.6 0.8 2.1 2.4 2.1 0.4 0.6 0 0						
18	0.1 0 0 0 0 0 0 0 0 0 0 3.7 0.7 0 14.9 5.1 0 5.7 6.3 16.9 0.7 6 12 1						
19	3.1 1.5 0.6 0 11.6 4 0 4.5 10.3 1.3 1.6 8.6 5 6.5 7.7 7.3 5.8 33.5 0.						
20	8.2 22.6 14.7 6.4 0.8 0 18.3 6.3 0 7.1 26.4 22.3 1 52.5 22.9 0.8						
21	21.5 36.2 42.2 40.3 42.2 33.9 38.4 41.4 19 15.7 40.7 28.1 25.1						
22	19.4 17.8 20.9 24.8 1.4 6.3 9.5 5.6 8.2 3 4.9 62.4 5.8 4.7 34.3 5.8						
23	1.7 0 0 0 1 5.7 0.8 7.5 0.6 0 4 7.4 0 6.6 2.9 3.2 0 0.2 4.2 0 0 0.6 0						
24	0.1 0 0 0 0 0 0 0 0 0 0						
25							
26							
27							
28							
29							
30							
31							

Total	263.3 201.2 398 256.4 213.3 270 210.9

1666

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1928 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.2 0.1 0 0 0.9 0 0 0 0 0 0 0 0 0 8.2 5.8 0 1 5.2 0 0.1 0 1.2 0 0 3.8 0						

Total	8.4 7.1 0 1 9.9 0 0.1

1667

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1929 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 2.8 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 2.8 0 0 0.3 0 0

1668

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1929 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0						
15	0 0.3 0.2 0 0 0.2 0 0 0 0 0 0 0.6 0 12.1 0.1 0 0 0 0 0 23.9 13.2 18.						
16	5 21.9 19.3 0.5 8.4 2.2 0.6 5.2 0.8 0.7 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 5.5 3.8 0 0.5 5.2 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 8 5.6 0 0.7 5						
18	0 16 0 36.6 0 0 4 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5						
19	3.4 0 0.4 3 0 0.5 9.4 0 0 0.3 0 0 0 16.5 11.9 0.4 9.1 12.8 0 7.6 7.7						
20	7.9 0 0.3 1.5 0 0 0.6 3.3 0 0 0.7 0 30.3 0.2 2.6 0 0 2.2 0 0 0 0 0 0						
21	0.8 0 0 4 3.3 0 10.9 6.1 2.9 5.8 10.5 0.9 7.8 17.8 6.6 0 8.4 0 0 0.6						
22	4.5 0 0						
23 24 25 26 27 28 29 30							

Total	83.4 98.8 19.5 62.7 73.5 3.4 115.2

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1929 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	20.4	9.6	42.1	38.3	19.9	39.3	18.9
12	56.5	40.4	100.8	79.8	53.4	83.7	137.8
13	64.1	43.3	29.3	43.4	76.6	24.7	32.1
14	24.9	32.3	42.2	9.5	19.8	10.2	12.4
15	30.4	12.4	19.5	5.8	22.2	9.7	6.1
16	2.5	0.3	1.8	0.9	6.7	2.9	2
17	20.2	14.5	9.4	33.4	10.5	10.8	14.8
18	25.1	40.1	26.4	39.1	24.3	24.1	28
19	23.5	6.9	7.4	23.6	7.3	2.4	5.5
20	8.6	12.1	6.7	88.9	54.6	40.3	87.4
21	82.8	94.3	88.1	57	48.3	76	70.6
22	31.5	26.7	32.9	35.5	29.6	5.8	38.7
23	26.7	24.2	82.5	22.8	38.4	17.9	85.7
24	50.8	53.4	32	40.8	30.3	26.3	28.8
25	66.1	82.1	54.3	74.6	44.7	77.4	36.9
26 27 28 29 30							

11	70.2	37.6	34.8	20	4.4	13.2	9.1	1.4	3.6	9.5	14.9	3.5	6.7	6.2
12	137.8	64.5	62.3	107.8	89.8	60.7	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
13	32.1	60.4	22.2	19.6	14.3	12.6	29.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2
14	12.4	14.7	16.4	27.4	20.1	19.6	5.1	30	0.2	0.2	0.2	0.2	0.2	0.2
15	27.5	15.7	32	2.4	0.9	0.9	0.8	10	0.1	0.2	0.2	0.2	0.2	0.2
16	4.4	13.2	9.1	1.4	3.6	9.5	14.9	3.5	6.7	6.2	0.2	0.2	0.2	0.2
17	14.8	5.1	34.7	19.8	17.8	20.4	38.1	16	0.2	0.2	0.2	0.2	0.2	0.2
18	28	25.5	22.7	23.7	46.9	33.6	14.1	8.3	0.2	0.2	0.2	0.2	0.2	0.2
19	9.3	2.3	1.9	9.6	6.2	8.1	6.6	12.1	12.1	0.2	0.2	0.2	0.2	0.2
20	87.4	70.2	45.7	39	78	63.4	110.1	94.3	0.2	0.2	0.2	0.2	0.2	0.2
21	76	70.6	52.2	49.3	59.8	24.6	23.7	26.9	42.6	0.2	0.2	0.2	0.2	0.2
22	38.7	35.6	50.9	32.6	43.9	38.2	117.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
23	85.7	53.9	28.9	70.2	37.6	34.8	20	0.2	0.2	0.2	0.2	0.2	0.2	0.2
24	28.8	50.8	27.1	19.8	56.4	22	57.8	33.8	0.2	0.2	0.2	0.2	0.2	0.2
25	36.9	142.1	64.8	53.6	119.1	50.9	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Total	973.1 760.9 1348 1214.5 931.7 1282.7 971.7

1670

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1929 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	44.2	28	38.6	51.8	31.8	22.8	39.7
12	44.8	36.9	24.5	29.4	48.7	26.5	29.7
13	21.4	23.1	27	19.1	9.3	25.2	14.5
14	5.7	14.1	18	17.5	32.6	13.9	14.5
15	18.4	39.4	19.5	15.5	74	34.4	15.2
16	18.8	9.3	12.6	8.8	22.9	11.2	10.4
17	7.4	24.4	13	8.2	18.8	13.7	8.3
18	18.3	14.8	58.1	23.8	16.7	25.3	17.5
19	12.2	23.2	7.8	8.7	11.8	10.4	21.4
20	24	27	23.3	33.6	21	18.3	28.1
21	23.7	20.6	26.2	14	37.4	36.1	41.1
22	24.1	27.2	26.4	23.4	23.9	18.8	16.6
23	30.6	29.4	24.7	33.5	19.1	17.5	22.9
24	10.9	12.8	15	6.8	8.1	11.1	6.6
25	4.2	26.3	8.8	2.2	7.2	4.1	0.5
26	22.1	19.7	17	5.4	15.7		
27 28 29 30 31							

Total	770.6 566.4 503.8 797.8 579.2 568.6 620.2

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1929 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	29.4 10.5 57.8 50.8 23.6 26.6 21.5 6.2 9.3 24.7 2.6 6.9 15 4.2 1.7 1.4 3.9 2.6 3.3 0.9 8.1 6.4 7.3 17.7 3 4.7 2.2 1.1 87.4 39.3 19.8 26.8 44.2 54.8 18 14.6 31.7 133.2 1.8 5.7 32.6 6 28 17 1.4 30 25. 21.3 14.3 1.8 17.8 6.3 15.8 8 9.4 8.2 37.5 29.5 6.5 18.3 28.7 23.6 11.6 0.9 0.6 1.7 0 0.5 1 0.9 0.5 0.3 0 0.3 0.4 1.2 1 14 9.8 0 1.9 9.2 0.3 0 0 0 0.3 0.7 0.3 1.8 26.1 23.5 7 2.1 18.3 16.2 12.1 11.3 7.4 11.2 8.6 8.8 0 3.5 10.7 3.2 1 2.1 0.2 0 0 11.7 4.8 0.5 1.6 3.7 1.8 0. 2.4 0.6 0.2 0.5 0 0 0 0 0 0 0 2.8 0 4.2 0 0 0 0 0 0 0 0 0 0 0.5 0.2 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6.8 0.9 0.6 1.3 1.7 0 0 15 1.5 1.3 2.8 3.1 0 0 3 0.3 0.3 0.6 0.7 0 0 1.1 0.1 0 0.2 0.2 0 0 1. 0.2 0.2 0.3 0.4 0 0 0 0 0 0 0 1.5 5.3 0 0 0 0 0 0 0						

Total	318.2 217 295.3 174.8 201.4 208.4 122.8

1672

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1929 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.9 0 0 0.1 0 0 0 0 0 0.5 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7.6 0.8 0 1.5 0 0 0 3.2 0.3 0.3 0.6 0						

Total	13.7 1.1 1.5 2.2 0 0.3 0

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1930 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1674

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year 1930 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 11.9 0 0 1.3 0						
18	3.1 0 1.9 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0 0						
21	1.5 0 0						
22 23 24 25 26 27 28 29 30							

Total	0 15 0 0 3 0 3.1

1675

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1930 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 1.9 0 0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.8 0.4 1.6 1.2 0.2 0.4 0.3 23.2 17.9 16 6.8 9.8 1 5 22.8 24.5 6.4 36.2 27.1 4.9 21.7 20.4 8.1 36.8 7.6 10.1 30.9 6.7 7.3 2 12.4 0.3 1.3 10 2.5 4.9 3.7 8.8 61.7 22.2 9.4 25.5 17 1.6 32.4 25.3 9.2 16.3 13.5 48.9 14 76.6 24.8 19.3 46.5 13.9 59.3 23.7 80.3 30.4 26.3 51.1 21.1 41 28.2 47.2 43.1 31.8 80.9 36.1 24.7 13.7 31.9 69.9 34.5 21.7 34.7 22.5 12.9 27.4 20.9 15.7 24 11.6 13.7 6.9 13.2 26.5 12.7 20.3 15.3 31.8 12.4 59.1 83.8 33.3 21 37.1 47.5 23.6 75.4 90.7 46.7 107.1 74.8 49.8 52.2 29.8 67.4 56.8 67.9 79.6 44.3 36.4 56.5 48.4 37.7 19.1 46.7 59.3 27.5 75.7 99.2 58.5 35.4 61 104.6 34.8 180.6 119.8 61 84.1 76.2 141.9 84.5 174 142.2 101 147.5 103.4 100.3 100.6 64.4 63.8 84 133.1 63.8 35 76.9 29 38.1 71.5 50.3 93.7 26.5 75.6 13.1 47.8 68.8 15.6 57.4 36.5 73 28.1 117.3 88.1 16.2 89.4						

Total	987.9 755.1 1179.1 1273.2 928.2 1015.8 991

1676

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1930 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	61.4	33.4	58	93.9	48.1	29.3	48.6
13	41.8	29.8	26.9	20.6	40.5	33.4	23
14	26.9	31.3	30	14.1	26.1	27.4	5.1
15	33.4	12.1	30.8	11.7	25.9	20.8	7.6
16	19.9	15.2	16.1	4.9	3.8	9.3	5
17	8.9	26.6	14.4	2.2	11.4	7.3	7.7
18	14.4	10.8	3.5	13.7	17.9	18.7	9.4
19	24.7	11	10	11.1	22.2	14.9	11
20	13.5	23.6	26.9	21.8	17.4	10.3	8
21	2.8	6	12.6	5.6	6.4	18.8	8.5
22	18.6	13.2	6.3	9.1	10.1	5	9
23	2.4	1	2.4	4.5	0.9	1.6	3
24	15.9	2.7	6	1.9	0.7	10.8	6.6
25	7.1	13.4	7.7	3.3	3.2	6.5	5
26							
27							
28							
29							
30							
31							

12	61.4	33.4	58	93.9	48.1	29.3	48.6	39.4	31.6	27.5	46.6	35.4	35.6
13	41.8	29.8	26.9	20.6	40.5	33.4	23	33.8	22.4	30.9	10.3	22.8	19.5 7.
14	26.9	31.3	30	14.1	26.1	27.4	5.1	36.6	35.9	56.9	11.7	23.6	35.6 11
15	33.4	12.1	30.8	11.7	25.9	20.8	7.6	36.1	19.4	28.4	4.6	11	18.9 12.8
16	19.9	15.2	16.1	4.9	3.8	9.3	5	22.5	7.6	8.1	4.3	13.6	9.5 2 8.5 10.1 6
17	8.9	26.6	14.4	2.2	11.4	7.3	7.7	5.6	32.3	16.4	9.4	20.5	18.4 15.3 15.
18	14.4	10.8	3.5	13.7	17.9	18.7	9.4	23.9	16.6	10	15.6	18.9	8.4 10.7
19	24.7	11	10	11.1	22.2	14.9	11	22.8	15.8	11.5	14.6	11.3	13.5 8.8 21.
20	13.5	23.6	26.9	21.8	17.4	10.3	8	8.9	10.1	12.4	13.1	9.3	8.1 10.5 8.
21	2.8	6	12.6	5.6	6.4	18.8	8.5	11.4	10.2	10.9	7.1	2.7	10.5 7.8 8.3 6.9
22	18.6	13.2	6.3	9.1	10.1	5	9	20.5	10.2	6.7	8.1	7.6	5.9 6 11.8 3.6 6 3.
23	2.4	1	2.4	4.5	0.9	1.6	3	1.4	13.5	3.2	4.5	0.5	4.2 5 1.5 1.6 2.1 16.1 6
24	15.9	2.7	6	1.9	0.7	10.8	6.6	4.8	12.7	8.3	8.5	7.1	9.5 7 9.6 9.8 5.3 6
25	7.1	13.4	7.7	3.3	3.2	6.5	5	3	2.6	1.7	0.4	6.1	4.9 0.7 2.2

Total	551.3 475.3 323.5 585.1 443.8 290.6 500.2

1677

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1930 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	6.6	5.5	6.1	7.4	7.7	8.6	5.2
14	0	0.7	5.3	0.5	0	18.5	13
15	0.1	0	0	1.1	0.3	3.5	0.3
16	28.7	14.3	16.6	18.4	20	23.2	31.3
17	32.4	14.7	12.7	16	12.6	10.1	7.5
18	36.7	7.3	20.5	38.7	18	10	19.6
19	3.1	3.3	7.2	11.5	12	4.1	6.6
20	1.6	7.6	0.8	3.3	1.5	0	0
21	0	0	0	0.3	0	7.3	2.5
22	0.5	0.2	0	0.2	8.7	3.1	13.2
23	26.7	34.5	6.9	61	5.8	4.8	9.8
24	22.7	3	12.2	4.4	2.3	3.8	2.3
25							
26							
27							
28							
29							
30							
31							

Total	340.9 243.4 165.7 241.9 237.4 254 243.4

1678

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1930 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0.2 0 4.8 1.7 2.1 2.2 0 9.5 0 0 1.4 0 0 1.3 0.9 0 0.1 0.8 0 0 2.3 2.6 0 0.2 2 0 2.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 12.1 0 0 8.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0.1 0.5 0.2 0						

Total	4.7 25.4 0.5 5.3 14 2.1 4.6

1679

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1931 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1680

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1931 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0.2	0	0	0	0	0	3.6
17	4	2.5	0.9	2.1	1.3	0	14.7
18	0	0	0	0	1	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	1.2	0
21	4.4	0	0	0.5	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	1.7
16	0	0	0	0	0	0	0
17	0.4	0.7	10.3	0	0.3	0	16.1
18	0	0	0	0	1.9	0	0
19	0	0	0	0	0	0	5.5
20	0	0	0	0	0	0	7.9
21	0.9	7	0.7	5	9.1	3.2	0.2

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	1.2	0.2	1.2	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0.3	0	16.1	0	0	3
18	0	0	0	0	1	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	7.1	1	1.4				

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	6.8	0	0	0			
18	0	0	0	0	0.2	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							

Total	5 51.1 11.1 3.4 28.5 10.3 28

1681

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1931 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	11.2 37.2 6.4 37 20.2 30.3 23.2 22.2 20.4 6.1 8.4 14.4 5 3.9 8.2 3. 52 21.1 10.1 1.2 14.7 0.5 2 73.1 25.9 14.6 60.6 25.2 4.3 1.1 59.6 5.7 4.8 16.4 18.7 10.8 7.6 19.5 0.9 6.7 10.2 0.8 0.1 0 0.5 0 0 0.4 0 0.4 0 0 1.6 0.6 0 0.6 1.7 0 2.2 0.5 1 1 1.6 1.8 0.1 4.3 2.3 1.1 1.9 1 1.6 0.4 4.1 8.8 3 1.5 3.8 12.8 4.8 33.7 2.5 5.4 3.2 1.7 21.6 4.7 29. 67.1 24.7 18.9 32.4 41.6 18.6 29 23.9 19.7 34.5 23.8 48.8 36.3 55.9 30.6 29.5 18.1 29.6 33.4 12.3 76.6 14 12.4 43.1 12.8 12.3 1 65.1 8 3.2 21.5 5.9 6.5 3 18.4 4.7 5.1 35.2 6.9 20.2 0.7 36.5 1 1.1 25.2 9.1 5.7 2.6 31.7 17.7 8.5 34 13.4 8.8 2.5 6.6 1.1 3.3 16.7 3.6 5.2 1.3 4.5 0.2 1.4 3.3 0.2 11.4 0.3 2.5 4.5 1.5 1.3 1.9 5.7 3.3 6.2 3.7 3.9 4 1.6 9.1 5.4 12.5 6.5 6.1 5.9 3.2 53.1 7.2 47.3 41.6 18 19 17.7 44.6 30.9 37.5 15.7 30.2 26.6 12.3 10.3 6.4 12.2 75.6 29.1 9 32.6 63.9 46.1 58.1 44.8 49.6 39.9 44.6 32.5 12.5 51.6 52.5 25.2 43.2 29.2						

Total	510.3 272.3 843 527.9 354.4 531.6 376

1682

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1931 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	67.3	38.7	24.4	34.3	29.3	41.9	22.5
12	37.4	48.9	23.1	24.6	16.2	21	59.3
13	44.5	26.2	55.1	126.8	58	6.2	52
14	95.4	118.1	144.2	92.2	115.2	129.2	104.3
15	85.4	57.4	60.4	37.6	51.8	17.3	29.1
16	49.8	32.5	11.1	36.7	40.5	49.1	17.4
17	30.4	39.5	12.8	31.8	85.2	44.2	16.8
18	26	54.1	47.3	24.2	37.9	67.5	49.2
19	20.4	61.5	57.8	48	55	36.9	43.1
20	12	43.1	38.6	17.1	34.1	27.1	27.3
21	6.9	27.5	18.1	11.6	16.4	30.4	24.1
22	8.7	35.4	32.7	13.4	41.4	37.4	60
23	17.7	37.6	42.8	8	23.2	75.3	34.9
24	11.5	27.9	23.2	11.9	11.5	17.5	12.2
25	6.6	19.1	22.7	10.6	22.1	38.3	14.2
26	64.3	34.1	17.3	32.5	35.6	37.2	22.8
27 28 29 30 31							

Total	1701.9 1412.8 715.4 1464.1 1249.1 836.7 1160.2

1683

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1931 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	23.3	18.3	15.6	7.6	18.2	16.5	8.1
14	40	12.9	5.6	1.6	5.1	28.9	14.4
15	64.7	55.6	62.6	53.4	47.2	35.6	22.8
16	41.3	20.2	65.3	50.2	35.4	47.9	30.6
17	12.8	15.3	11.9	14.8	6.8	6.8	17.6
18	3.5	1.2	11.1	0.7	3.1	14.1	4.9
19	12	13.4	2.7	51.1	26.6	12	24.2
20	1.3	2.6	3.4	8	3	1	0.6
21	0.4	0	0	3.5	2.4	0.1	28.8
22	16.6	1.5	1.9	9	1.2	0.2	1.4
23	0	0	0	0	0	0	0
24	0.4	2.9	2.9	0.4	1.3	1.5	0
25							
26							
27							
28							
29							
30							
31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
13	7	3.3	4.7	3.8	2.4	19.7	2.5
14	5.3	35.3	12.5	35.8	67.5	35.4	21
15	30	32.8	39.6	31.6	12	49.8	
16	73.7	41.5	56.7	15.5	10.8	3.3	
17	1.6	5.7	32.5	5.5	1.6	1.6	2.7
18	13.2	13.6	5.7	17.7	15	14.6	9.4
19	4	6.1	3.7	13.5	11.2	14.1	8.7
20	0	7	0	0	0.8	0	0
21	11.1	8	7.1	7.2	13.2	6.3	5
22	0	0	0.2	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0.9	0.8	0.1		
25							
26							
27							
28							
29							
30							
31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
13	3.8	2.4	19.7	2.5			
14	35.8	67.5	35.4	21			
15	31.6	12	49.8				
16	15.5	10.8	3.3				
17	1.6	1.6	2.7	1.8	1.1		
18	17.7	15	14.6	9.4			
19	8.7	12.1	2.9				
20	2.5	0.6	0.2	0.4			
21	6.3	5	6.3	6.5	2.7		
22	0	0	0	0	0	0	0
23	8.9	6.6	11.4	5			
24							
25							
26							
27							
28							
29							
30							
31							

Total	374.3 264.6 284.1 464.3 359.9 355.9 358.5

1684

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1931 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7 0.8 0.7 1.5 0 0 0 19.2 2.4 15.5 22.5 7.5 0 8.7 13.7 24.8 16.1 10 16.1 23.4 16.8 8.1 9.9 5 0.2 6 5.9 4.4 3.1 4.1 0 0.2 4.2 0 1.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	52 42 37.3 34.4 33.8 29.3 31.3

1685

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year 1932 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0 0 0 0 0 0

1686

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1932 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0.1 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.6 0.6 0 0.6 0 17.9 0 0 2.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0.2 0 0.2 0 0 0 0 0.3 0 0 0 0 0 0 0 17.4 0 0 0 0 0 0 0 0.6 17.1 0 0 4.2 0 11.6 0 0 0 0 0 0.6 0 0 12.3 0 2.3 0.6 8.8 0 0 0 0 0 0.6 0.2 0 0 0 0 0 0 2.7						

Total	0.8 47.4 0 2.1 10.7 1.8 41.5

1687

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1932 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0.9 1.6 0.6 0 0.6 0.3 0.6 2.2 9 3.3 0.4 3.5 7.5 5.3 13 63.6 24.1 1.8 25.4 19.1 11.4 45.6 24.4 13.3 12.5 11.1 15.3 15.6 34.4 1.4 10. 49.6 7 1 3.7 17.4 4 2.2 6.1 2.8 20.9 6 47 28.2 12.6 2.5 11.1 30 8.6 55.2 12.9 11.1 29 13.4 26 13.6 24.2 6.5 12.4 38.5 7.1 41.3 19.2 4. 7.6 17 8.6 3.7 20.8 10.2 44 17 12.6 3.7 6.5 29.2 11.2 15.3 9.4 11.2 8.9 4 3.9 5.9 9.4 2.4 3.7 10.8 3.9 17.6 6.1 3.9 7 7.2 2 2.6 4.6 1.9 3.4 37 13 4.4 14.8 27.2 25.7 15.3 26.2 24.3 26.2 26.9 22.3 16 43. 26.8 19.3 22.6 23.6 24.7 28.7 21.4 7.7 18.3 26.6 11.2 9 3.4 11.8 22.1 11.4 7.6 10.8 23.9 11.8 13.2 13.5 9.5 24 8.3 23.4 7.9 34.3 25 9.9 16.6 11.1 20.2 19.1 33.6 28.6 18.5 56.9 23.3 38.9 20.5 77.6 43.8 24.7 41.9 26.9 35.6 26.8 63.5 38.9 27.2 52.6 24.5 29.8 29 37.1 7.4 21.5 39.9 12.5 32.6 23.9 32.6 26.3 22.7 28.2 15.9 10.2 7 15.3 1.8 7.4 31.4 6.3 20.9 1.3 20.6 21.6 7.6 0 8.8 3.6 6.3 9.1 39.3 15.5 11.1 16.4 6.1 2.2 4 6.7 4.5 6.4 4.4						

Total	565.9 349.2 752.7 568.1 396.8 570.8 348.4

1688

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1932 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	33.3	70.8	4.5	23.7	53.1	15.8	47
13	66.7	108.5	50.4	127.1	101.8	54.1	101.3
14	132.6	80	78.5	74.8	53.8	63.1	54.6
15	41.7	36.8	56.3	48.4	35.5	35.8	50.3
16	61.3	40.9	24.7	45.3	53.4	27.8	10
17	45.5	24.4	18.6	25.4	42.5	14.3	12.3
18	3	4.4	4	4.2	0.7	0.6	0.8
19	3.6	5.4	7.1	0	2.7	0.6	19.8
20	0.4	22.7	2.3	2.1	4.4	0	0.4
21	2.8	0	1.5	6.1	2.8	0.3	0.8
22	2.2	0.6	1.4	0.5	0.1	1	15.7
23	15.1	1.6	1.4	3	0	0	0
24	9.9	2.8	6.1	1.2	6.2	19	6.3
25	28.3	28.3	16.4	5.7	20.2	22.5	37.9
26							
27							
28							
29							
30							
31							

Total	881.9 671.2 401.3 792.2 665.4 485 695.1

1689

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1932 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	3.8	0.4	0.3	0.7	0.3	0	2.3 61.9 7 33.1 58.6 17.7 11.9 21.7 18 5.4 21
14	9.7	3.6	17.8	12.8	7.5	3.5	1.9 33.5 14.3 0.8 13.1 4.1 7.7 0.4 0.8 3.5
15	2.5	2.8	3.1	3	0.2	22.1	9.2 0 8.4 4.5 5.3 3.6 21.3 17.2 5.9 16.3 3.9
16	1.3	4.7	16	7.1	10.5	10.8	3.9 2 9.4 8.2 9.3 1.1 5.6 4 20 0.5 0.7 2.1 (
17	0	4.5	0.5	0.4	0.9	0	0 0 0 0 0 0 0 0 0 2 0.1 0 1.4 0.4 0 0.5 7.9 4.3 3
18	35.5	13.3	0.6	14.8	15.2	34.6	10.3 7.2 11.9 35.9 10.2 7.4 3.9 7.9 0.
19	7.7	23.9	13	2.2	5.8	0.7	7.3 3.1 3 4 11.3 6.1 9.5 5.1 6.7 0.7 2.1 3.3
20	2.7	10.1	23.2	8.5	0.2	11.8	15 32 32.1 8.8 18.4 31.5 15 38.1 7.4 13
21	37.6	14.6	5.9	30.9	16.1	6	12.6 6 5.4 10.5 4 4.8 3.4 0.6 0.4 3 5.6 1
22	0	0	0.8	1.8	0.6	4.7	1.9 1.6 0.4 2.9 7.8 2.7 0 5.4 3.3 2.5 13.8 2.3 1.4
23	5.2	2.5	2.4	8.6	1.7	0.6	7 18.3 10.4 20.1 10.6 21.6 17.7 10.9 3.3
24	12.7	8.3	35	29.7	0.5	16.1	24.9 18.2 1.1 0.8 0 0 0.7 0 0 0 0 0 0 0 0
25							
26							
27							
28							
29							
30							
31							

Total	279.3 220.3 247.4 336.6 216.7 224.7 252.5

1690

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1932 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	8.4 0 0 0.3 1.1 0 0 7.6 0.8 1 1.5 0 10.7 1.5 0 0 0 0 0 0 0 0 0 0 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 18.9 1.9 1.7 3. 0 0 0 1.6 0.2 0.1 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0.2 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0.1 0 0 0 0 0 0 0 0 0 0						

Total	38.5 2.9 2.8 6.1 1.1 10.7 1.5

1691

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1933 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 1.7 0 0.2 1.1 0						

Total	0 0 1.7 0 0.2 1.1 0

1692

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year -1933 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 1.9 0 0 0 0 1.7 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.8 1.2 0.4 0 0.5 29.3 1.6 45.2 11.2 4.5 3.3 3.9 11.4 6.1 32.5 0.8 6.5 19.3 0.8 1 0.1 8.1 0 0.1 7.4 0.7 0 0 0 0 0 0.5 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 13.6 0 0 0 0 0 0.2 11 4.6 1.9 6.7 9.1 0 0.3 0 0 0.2 2.3 2.3 0 0 0 0 0 0 0 7 4.9 0 0.6 7.7 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	48.7 13.2 113.4 18.4 25 39.5 20.2

1693

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1933 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	31.9 43.9 36.7 63.8 44.5 24.9 36.2 20.1 20 19.2 50.1 31.5 32.9 36.7 19.6 23.8 19.8 84.7 43.7 30.1 40.2 85.1 48.6 40.7 116.9 79.8 21.1 65.8 15.7 67.4 29.9 69.8 58.6 78.3 65.5 44.1 35 31.4 20.6 35.2 32.1 24.6 14.1 21.7 19.5 9.4 14.3 24.9 13.6 41.3 14.3 53.4 95.6 40.7 21.2 41.9 65.7 38.4 95.3 79.3 49.2 55.2 51.3 19.3 18.7 51.4 13.5 20.4 78 28 3.8 6.2 5.4 2.4 3.9 17.3 6.7 4.6 1.5 3.2 1.8 1 3.5 1.1 8 6 2.1 12.1 8.8 0.3 4.5 87.9 38.1 66.8 171.5 84.6 9.7 67.4 56.9 78.6 65.6 87.3 71.4 143.2 94 45.4 38.9 28.2 73.9 47.2 85.1 52.7 30.2 14.2 43.4 48.5 25.3 40.3 23.9 47.6 16.8 53.9 69.9 31.2 52.4 32.9 10.6 46.4 20.8 39 25.9 69.7 34.4 6.4 18.9 3 17.9 24.2 10.3 35.1 8 9.3 3.1 25.8 14.1 13.3 17.5 5.3 9.8 5 10.5 9.3 11.3 10. 14.7 12 2.4 12.3 12.4 16.9 19 9.3 12.3 10.1 15.1 14.8 12.3 13.8 44.2 32.9 31.5 35.1 30.7 11.2 23.7 49.7 39.3 40.9 48.7 40.7 25.6 39.6 14.6 16.4 22.1 16.9 26.7 58 40.4 75.4 39.9 20.3 35.6 47.8 13.2 30.7 55.3 34.4 104 60.3 43.9 43 34.9 93 41.1 95.5 87.6 54.4 83.9 54.7						

Total	1027.8 844.8 1024.6 1475.9 1036.3 1119.2 1041.2

1694

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1933 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	78.4	96.9	44.6	84.5	77.3	61.2	76.8
13	55.1	55.9	82.8	28	94.3	74.8	38.6
14	97.7	70.6	35.6	56.7	34.2	54.1	54.8
15	25.9	29.5	28.7	33.5	25.7	11.5	20.9
16	27.4	18.4	16.7	53.3	27.2	13	30.5
17	24.7	21	16.9	29.2	18	12.8	12.2
18	15.9	6.3	14	3.3	1.7	2.5	1.4
19	9.8	6.7	2.1	3.6	4.1	6.4	8.6
20	1.8	2	0.6	0.9	1.4	0.8	0
21	20.4	16.5	0	16.1	21.4	20.6	6.4
22	11.5	9.2	0.8	0	0.3	0	2.3
23	2.4	5.3	10.2	3.1	18.5	7.9	4.3
24	8.6	1.7	3.9	1.8	0.2	13.4	5.5
25	2.9	2.6	5.6	0	2.9	0.8	18.5
26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	49.1	69.5					
13	59.1	35.9	27.1	53.5			
14	35.7	37.2	23.7	16			
15	9.9	19	45.2	33.3	6.2	24.3	
16	19.2	23.3	22.5	10.6			
17	42.7	18.7	18.7	10	6	3.2	1.8
18	2.7	1.2	1.8	4.6	4.4	2	1.9
19	3.9	7.1	2.7	1.5	0.2	0.1	0.3
20	16.5	7.9	0.7	3.1	7	0.2	0.9
21	17.5	11.1	21.9	1.1	1.4	8.3	0.4
22	4.2	2.9	3.1	0	1.9	2.8	0
23	11.2	11.4	15.2	7.1	11.5	2.9	3.6
24	1.8	5.5	24.3	2.6	2.6	5.9	0.4
25	1.9	1.7	3.6	0	0	0	
26 27 28 29 30 31							

Total	717.3 648.8 323 511.3 531.4 515 558

1695

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1933 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	10.2	15	4.2	19.6	16	50	28
14	4.7	0.9	4.7	3.3	4	15.8	2.1
15	11.2	7.6	5	0.6	1	4.4	1.2
16	34.6	23.2	26.9	30.9	31.6	20.4	22.8
17	22.3	15.1	13.8	49.6	8.2	37.6	9.8
18	11.1	6.8	10.8	15.2	23.5	14.8	26.3
19	8.5	13.4	6.9	1	17.6	10.6	11.4
20	8.3	1.6	1.7	5.4	0	0	7.3
21	17	5.5	2	0.8	1.9	1.6	2
22	9.1	4	14.4	6.6	1.8	0.5	1.9
23	1	3.8	3.3	3.7	5.9	10.1	0
24	1.7	0	0	1.2	0	1.1	0.1
25 26 27 28 29 30 31							

Date	74°E 16°0'N	74°15'E 16°0'N	73°45'E 16°15'N	74°E 16°15'N	74°15'E 16°15'N	73°45'E 16°30'N	74°E 16°30
1 2 3 4 5 6 7 8 9 10 11 12							
13	4.2	19.6	16	50	28	1.6	8.2
14	4.7	3.3	4	15.8	2.1	28.4	0.3
15	5	0.6	1	4.4	1.2	7.3	6.6
16	26.9	30.9	31.6	20.4	22.8	68.1	36.9
17	13.8	49.6	8.2	37.6	9.8	5	7.2
18	10.8	15.2	23.5	14.8	26.3	14.2	14.6
19	6.9	1	17.6	10.6	11.4	13.7	10.2
20	1.7	5.4	0	0	7.3	16.1	2
21	2	0.8	1.9	1.6	2	1.2	1.2
22	14.4	6.6	1.8	0.5	1.9	0	0.4
23	3.3	3.7	5.9	10.1	0	4.2	1.9
24	0	1.2	0	1.1	0.1	0.1	0.2
25 26 27 28 29 30 31							

Date	74°E 16°30'N	74°15'E 16°30'N	73°45'E 16°45'N	74°E 16°45'N	74°15'E 16°45'N	73°45'E 17°0'N	74°E 17°0'N
1 2 3 4 5 6 7 8 9 10 11 12							
13	28	1.6	8.2	0.5	9.5	7	4.2
14	2.1	28.4	0.3	6.1	3.1	3.2	11.4
15	1.2	7.3	6.6	2	8.8	14.6	5.7
16	22.8	68.1	36.9	17.4	40.6	8.2	5.6
17	9.8	5	7.2	9.8	7.4	19.5	8.6
18	14.2	26.3	14.2	14.6	12.3	8.4	13.2
19	13.7	10.2	7.8	0.9	3.5	8.7	1.7
20	16.1	2	20.8	20.9	2.2	19.6	11.3
21	1.2	5.3	1.4	1.9	2.8	2.1	4.7
22	1.9	0	0.4	1.3	0	6.2	8.5
23	3.1	49.8	9	0	0	1.9	0
24	0.1	0.2	0	0	7.6	0.8	0.7
25 26 27 28 29 30 31							

Date	74°E 17°15'N	74°15'E 17°15'N	73°45'E 17°30'N	74°E 17°30'N	74°15'E 17°30'N	73°45'E 17°45'N	74°E 17°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	13.7	2.8	16.1	0	2.8		
14	3.2	11.4	17.5	15.9	13.8		
15	14.6	5.7	0	5.3	38.5	23.8	11.6
16	68.1	36.9	17.4	40.6	8.2	5.6	10
17	19.5	8.6	11.6	11	5	9	
18	26.3	14.2	14.6	12.3	8.4	13.2	14.4
19	13.7	10.2	7.8	0.9	3.5	8.7	1.7
20	16.1	2	20.8	20.9	2.2	19.6	11.3
21	1.2	5.3	1.4	1.9	2.8	2.1	4.7
22	1.9	0	0.4	1.3	0	6.2	8.5
23	3.1	49.8	9	0	0	1.9	0
24	0.1	0.2	0	0	7.6	0.8	0.7
25 26 27 28 29 30 31							

Total	245.1 232 158.8 318.9 268.9 332.1 344.9

1696

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year 1933 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 4.5 0.5 0.4 0.9 0 0 0 0 0 0 0 0 0 6.4 0.7 0.6 1.3 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 2.2 0.4 0.9 1.7 0.8 0 0.6 13.2 7.2 5.2 13.3						
19	8.1 0.7 5 0 17.5 5.1 0 2.4 14.3 4.9 0 4 3.6 0 3.6 1.5 0.2 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0.3 0 5.8 2 0 2.9 2.6 0.3 0.2 0.5 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0						
23 24 25 26 27 28 29 30 31							

Total	28.9 30.9 16 23.5 16.9 16.5 13.6

1697

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1934 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1698

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1934 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.1 0 0 0 0 0 0 0 8.9 0 0 0.3 0 0 0.7 0 3.1 0.2 10.3 4.3 0 2.9 2 0 0.5 12.6 0 1.4 3.7 3.1 0 0.3 9 0 0 0 0 0 0 0 0 0 0.3 0.2 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 0 0 1.1 6 0 0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	16.9 14.4 0.2 11.4 29.5 0 13.1

1699

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1934 : Month - June							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.6 0.4 0 0.2 0.3 0 0 6.6 1.3 0.8 8.8 3.7 0.2 3.3 1.4 0.2 6.1 5.1 4.7 14.4 4.6 3.3 0.7 3 0.1 0.6 0.2 0 1.9 15 11.7 0.1 2.6 9.2 1.5 22.5 5. 35.2 26.6 12.3 2.3 10.2 36.9 16 82 29.5 21.2 40.5 19.3 52.7 53.3 65.9 62.1 45.5 69.9 46.9 17.9 44.4 79.7 96.9 51.1 93.6 71.8 42.4 20.7 87.7 49.4 33.4 132.8 47.9 47 31.7 36.2 84.2 50.5 66.9 55 24 19.2 22.3 53.7 30.9 49.4 52 51.2 27.3 28.7 40.8 36.5 40.9 29.6 38.4 24.6 53.9 38.3 27.9 40.7 28.9 48.7 18.7 118.1 52.8 31.7 44.3 29.7 22.2 23.8 73.1 59.3 36.8 78.2 45.9 8.8 18.6 44.5 45.1 33.9 97.5 49.8 38.4 33.9 30 61.2 59.9 30.9 49.4 25.1 50.1 27.2 28.3 34.2 28.6 50.5 65.9 55.1 4 36.2 45.1 27 27.1 77.1 60.7 36.1 137.7 81.1 23.5 85.5 45.4 64.4 61 69.1 55.8 86.9 54.8 87.9 72.2 105.4 209.5 126.8 58.7 132.2 71.5 81 121.3 66.4 79.6 213.3 82.1 46.6 43.9 50.1 50.8 48.6 94.4 58.6						

Total	889.5 782.3 1184 1312.2 954.7 1344.3 1036.6

1700

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1934 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	47.9	23.4	47	48.9	26.8	65.5	36.1
12	52.8	9.3	17.9	4.1	21.4	18	31.4
13	29.6	20	15.1	8.2	24.3	15.2	9.5
14	17.8	23	2.7	29.4	21.5	7.2	22.9
15	16	77.3	53.4	8.2	31.6	80.1	89.5
16	51	40.5	61.3	148.8	87.2	28.7	41.1
17	22.1	50.6	52.4	11.4	40.7	42.7	42.5
18	73.1	106.7	148.7	102.9	42.6	77.4	37.4
19	86.4	12.8	52	18.4	31.1	35.4	98.8
20	24.9	41.3	18.2	19.9	9.6	15.1	14.5
21	14.6	12.7	8.4	2	6.8	7.8	5.7
22	5.5	3.6	5.6	4.1	5.5	17.4	12.1
23	28.5	23.2	9.9	11.4	17.7	18.9	8.2
24	2.1	4.8	8.5	7.9	3.4	17.8	12.1
25	30.3	10.2	4.1	19.4	7.9	1.1	7.2
26							
27							
28							
29							
30							
31							

Total	926.8 943.3 629.3 1049.3 897.2 862.6 905.8

1701

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1934 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	21.9 15.4 0.1 8.7 15.3 1.2 3.7 15.8 3.3 1.4 3.1 0.2 1.3 0.4 4.2 0.4 0.4 0.8 0 0 0 0.4 0 0 0 0 0 0 1.3 0.1 0.1 0.3 0 0 0 22.5 15.7 0 1.9 15.4 0 1.3 1.7 0.6 0 0.2 0.4 11.4 2.6 16.4 10.7 0.1 1.5 9.5 2.3 0.3 11.7 7.5 9 1.1 6.6 0.6 0 1.8 1.3 1.6 26.4 9.1 2.2 10.5 13.9 4.9 2.2 4.6 4.3 0.4 1 30.9 26.8 4.7 20.8 32.1 1.4 14.1 6.8 21.1 2.7 5.8 16.3 10.1 17.5 6.4 2.2 0 0.3 1.5 1.6 24.8 1 0.2 0 0.2 0 3 0.9 1 0.1 0 0.2 0 0 0.1 0 0 0 0 0 0 15 4.5 1 27.5 10.6 0 9.7 2.3 0.6 0.2 0.4 5.6 0 0 8.9 0.9 0.9 1.8 0 0 0 4.8 0.5 0.4 0.9 0 0 0 1.1 0.1 0.5 0.2 0 0.5 0 1 0.1 0.1 0.3 0 0 0 9.9 1 0.9 1.9 0 0 0 6.9 0.7 0.6 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0.1 0.1 0.3 0 0 0 27.7 2.8 2.5 5.4 0 0 0 16.6 9.7 17 6.6 9.9 2.6 2.3 15.3 15.5 24.7 12.4 13.9 3.3 8.4						

Total	269.1 146.8 71.2 134.9 150.9 41.9 97.5

1702

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1934 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	4.7 0.5 0.4 0.9 0 0 0 6.7 0.7 0.6 1.3 0 0 0 3.6 0.4 0.3 0.7 0						

Total	15 1.6 1.3 2.9 0 0 0

1703

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year -1935 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0.2 0.2 0.4 0						

Total	2 0.2 0.5 0.4 0 0 0

1704

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1935 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 1.5 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0.7 1.5 0.7 0 2.5 0 0

1705

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1935 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
13	0.7 0.5 1.7 0.3 0.5 0 0.1 1 0.8 0.6 2.8 1.6 0.8 1.2 0.3 0.3 1.3 0.3 0						
14	2.3 0.7 1.7 1.2 0 0.1 1.1 1.7 0.3 1.3 0.8 0.1 4 1.9 0 1.5 29.7 13.4						
15	24.6 5.4 12.8 0.5 1.3 10 6.3 38 2.3 5.5 33.8 4.4 45.7 13.2 25.8 38						
16	23 15.6 16.4 48.1 18.3 71.1 25.4 19.3 54.4 17.4 40.2 25.7 66.3						
17	36.9 24.7 45.1 18.5 64.2 31.8 65.5 103.3 56.1 64.8 53.5 22.1 29.9						
18	68.9 37.9 33.8 102.1 54.3 24.4 23.3 30.2 31.7 20.3 73.4 54.2 18.5						
19	12.9 26.2 30.6 18.8 8.8 21.9 20.9 22.7 33.3 63.2 35.1 59 37 16.6						
20	37.4 20.1 13.4 17.8 33.9 14.1 14.1 13.9 32.9 39.3 18.5 16 19.4 13						
21	7.4 21.1 4.9 6.1 39.7 10 11 7.6 56 37.1 16.9 9.6 16 26.3 3.1 35.9						
22	7.5 4.5 93 27 10.3 6.3 14.5 13.3 8.9 7.3 7.7 15.8 8.7 38.8 23 14.5						
23	24.5 17.3 31.3 17.4 16.9 36.4 26.2 49.5 23.9 27.9 14.5 20.7 33.6						
24	18.5 11.2 15.8 12.5 6.1 41.5 23.5 10.9 77.2 22.3						
25 26 27 28 29 30							

Total	507.6 323.5 752 615 397.6 824.2 456.2

1706

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1935 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	22.7	23.4	16.2	8.9	14.3	11.1	16.6 25.9 47.9 18.9 30.7 24.4 9.3 24.
13	20.7	11.5	5.7	9	6.8	4.3	8.7 20.6 9.8 13.8 20.4 9.8 3.2 12.2 89.9 28
14	18.8	30	20	10.8	14.2	24.6	13.3 9.4 22.4 15.4 6.3 14.5 15.2 14 5.3
15	12.1	7.6	7.9	9.1	12.5	10.1	9.5 8.5 7 3.9 4.3 9.9 3.4 4 5.6 3.8 5.7 6
16	7.3	3.9	3.1	33.9	13.8	1.4	14.4 6.6 9.6 2.5 9.9 11.1 3.5 8.9 16.9 11
17	4.1	3.9	7.8	14.2	7.9	15.4	10.5 3.5 3.4 6.6 1.4 4.2 13.7 6.7 2.3 7.2
18	5.5	1.9	4.2	9.5	6	4.9	3.6 5.5 2.2 2.4 8.2 4.3 23.5 12.6 6.7 7.8 5.3
19	29.2	17.1	21.7	34.6	21.2	29.7	18.3 40 11.2 15.9 25 11.4 14.5 10.3
20	17.3	11.8	8.6	9.3	9.8	19.2	6.9 8.8 3.5 2.8 11.4 6.2 5.1 6.1 57.3 38.
21	11.9	5.5	34.3	10.2	2.8	21	11.5 13.9 4 10.7 0.3 2.3 23.7 16.1 12.2
22	30.8	23.5	7.8	12.4	32.3	38.5	11.3 12.6 13 37 11.4 15.1 17 2.4 25.(
23	13.3	6.9	13.3	28.2	13.4	5.6	18.1 19.6 8.7 8.6 16.9 18.4 27.3 2.9 8
24	5.4	5.1	24.2	17	17.3	18.3	11 44.8 14.7 14.2 3.6 4.4 3.6 3.7 21.9 5.
25	12.2	3.8	1.5	9.4	5	1	3.1 9.9 3.1 3.1 7 3.2 4.5 8.6
26 27 28 29 30 31							

Total	669.9 438.6 305.4 440.2 360.9 311.9 286.8

1707

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1935 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	2.6	0.3	0.2	0.5	0	0	0
14	17.5	0	12.4	11.4	4	6.3	26.6
15	13.8	5.5	9.5	8.6	2.4	2.5	14.8
16	0.3	13.8	1.4	1.3	2.7	0	0
17	6.3	0.6	0.6	1.2	0	0	0
18	2.7	17.3	2.9	11.9	11.9	5.2	8.4
19	4.8	0.8	4.2	1.3	9.2	2.3	8.6
20	3.2	2.1	0.3	2.5	21	8.6	6.8
21	6.9	9.5	13.7	6.6	1.5	7.2	0.2
22	0.2	0.3	0	0	0.1	0	0
23	1.4	0.1	1	0	0	0	1.6
24	10.9	0.6	8.9	5.8	0.4	9.6	
25 26 27 28 29 30 31							

Total	203.4 167.5 73 137.4 129.1 66 95.7

1708

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1935 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	3.8 0.4 0.3 0.7 0 0 0 3.5 0.4 0.3 0.7 0 0 0 0.7 0 0 0.1 0 0 0 4.2 0.4 0.4 0.8 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	12.2 1.2 1 2.3 0 0 0.8

1709

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1936 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0 0 0 0 0 0

1710

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1936 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0.7	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	3.3
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0.3	0	0	0.1			
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	1.6	0	0	3	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0.5	0.2
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.2	0	0.2	4.2	9.9	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	1.3
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0

Total	4.2 14.8 0 0.8 4.9 0 1

1711

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1936 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	48.6	28.4	26.6	18.3	10.6	12.7	9.3 11.5 15.1 34.1 21.5 16.7 19 8.9
12	12.7	10	12.1	5.9	7.4	20.5	7.2 7.7 4.2 29.8 41.8 16.5 2.9 16.7 23.4
13	25.5	62.2	60.8	41.6	27.3	30.1	77.4 50.8 55.7 9.7 18.8 101.1 30.2
14	6.6	7.4	16.6	2	6.9	7.8	1 11.6 3.6 12.1 25.4 11.6 20 25.3 46.3 15.6
15	43.2	24.1	12	42.6	15.5	7.6	5 16.6 4.1 5 33.7 6.5 4.3 7.2 1.7 1.8 1.
16	1.2	0.7	6.3	5.9	6.7	4.4	6.3 1.2 1.7 17.2 7.4 9.8 9 7.2 17 7.1 21.1 9
17	7.9	13.3	7.7	7	9.4	18.1	12.9 6.4 23.1 14.2 6.3 10.8 18.1 19.2 45
18	78.7	37	12.2	39.6	27.4	17.8	29.1 50.6 27.3 37.6 31.6 34.1 21.9 11
19	33.2	29	28.3	26.3	18.8	12.7	2.9 0 6.2 26.4 15 8.6 8.1 24.2 71.6
20	29.8	4.9	28.6	43	23.3	60.3	35.8 28.1 92.4 25.6 66.2 43.6 48.8 28.
21	25.6	40.1	22.5	95.9	44.6	49.7	39.6 34.1 72 37.8 69.8 52.9 53.4 11
22	73.1	56.8	58.6	106.5	92.9	118.4	105.3 97.1 149 116.6 96.7 77.8
23	49.3	50.4	63.1	146.9	120.4	54.5	94.2 36.2 51.3 121.7 74.9 101.2
24	44	60.2	29.4	46.2	65.5	57.2	82.8 31.4 37.7 14.6 16.3 29 50.1 60.2
25	23.2	29.3	1.9	14.8	17	2.5	19.9
26							
27							
28							
29							
30							

Total	1058.6 844.7 916.2 998.5 867.7 1171.6 967.1

1712

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1936 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	66.8	68	36.5	40	37.9	78.9	51.7 25.2 23.8 16.1 17 18.7 19.5 18.1
13	14.9	15.2	7.8	8	12	31.4	18 11.6 17.2 5.2 19.8 23.1 9 20.5 11 16 4
14	14.6	24.3	8.2	13.5	29.8	24.4	7.1 33.7 26.3 7.8 22.1 32 34.8 14.5
15	16.9	21.8	26.7	38.1	11.6	9.2	3.2 11.6 10.2 9.5 14.5 15.4 16 2.2 6.2
16	13.2	1.5	13.9	9.2	6.5	6.2	45.2 19.5 2.3 24.3 24.6 48.5 6.7 10 33.8
17	7.1	15.1	15	19.1	4.8	16.9	13.8 8.7 36.7 20 21.7 2 14.5 16.6 4.8
18	19.5	10.5	6.6	10.4	36.8	15.2	5.3 14.4 31.7 29.7 17.8 37.7 26.3 30
19	20.9	30.4	25.1	37.9	58.6	35.9	26.8 43.3 33 30.5 36.7 55.4 35.6
20	95.9	59.8	20	29	16.2	28.7	23.4 35.8 27 11.7 15 10.5 20 19.4 17.8
21	23.8	7.1	6.7	3.5	6	6	13.2 8.9 3.9 4 4.3 8.7 5.7 3.3 5.2 5.5 3.1 4.4
22	8.1	5.9	2.4	4.5	4.1	1.7	2.1 2.9 1.8 1.4 1 0.9 0.5 1.9 0.3 0.4 1.6 0.3
23	3.3	1.4	7.2	16	6.6	7	7.8 8.2 3.8 11.6 7.1 4.7 17.7 11.3 13.7 20.8 7.
24	6.9	9.7	2.1	2.8	3.6	6.5	3.1 11.2 5.3 2.4 6.3 22 13.4 6.3 9 8.5 5.8 7.
25	23.6	20.9	11.3	23.3	16.9	16.1	13 26.3 15.9 11.3 26.5 14.4 8.3 10.3
26							
27							
28							
29							
30							
31							

Total	546.6 555 320 617.6 512.9 508.8 574

1713

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1936 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.7 0.8 2.2 14.1 7.3 5.8 6 28.5 16.1 60 43.9 30.1 2.8 36.9 93.6 37 43.5 2.4 9.1 117.9 63.9 4.9 3.1 10.9 48.2 17 0.8 23.4 94.1 30.8 5. 0.1 0.1 11 1.8 0 0 0 0 0 0 0 0.9 0.4 0.4 0.8 0.1 0 0 1.6 0.5 0.5 1.2 0.5 0 0 2.5 0.4 0.9 2.1 0.4 0 0 0.2 0 0 0.2 0.6 0 13.1 0.1 0 0 0.1 0 0 0.2 0 0 0.1 0 0 0 0 0 0 0.6 0 0 0 0 0 3.4 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0.2 0.2 0 0 0.2 0 0 0.8 0 0.4 0 0 0 0 5.4 1.6 0.6 0.4 0 0 0 0 0 0 0 0 0 0.1 0 0 0.1 0 0 0 0.6 0 0.2 0.5 0 0 0 0.5 0.2 0 0 0 0 0 1 0.6 0 0.2 0 1.9 2 0.8 0.3 0 0 0 0 0 1.2 0 0.5 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 1.9 0 0.2 1.7 0 0 2.1 2.7 0 0.4 2.6 0 0						

Total	243.4 97.5 125.4 116.1 73.8 140.2 147.1

1714

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1936 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0.2 0.5 0 0 0 2.6 0 1.1 2.4 0 0 0 0.4 0.2 0.3 0 0 0 0 0 0 0 0 0 1.7 0 0.7 1.6 0 0 0 0.6 0 0.3 0.6 0 0 0 0 0 0 0 0 0 0.4 0 0.2 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.7 0 0.7 1.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	7.9 0 3.4 7.3 0 0 0

1715

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1937 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1716

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1937 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0.1 0 15.4 0 22.1 12.9 13 2.4 12.5 0 0 53.9 38.8 54.3 30.7 35.6 7 13.8 42.2 35.3 77 53.5 36.3 177.3 62.6 11.6 6.6 14.5 7.6 3.3 506. 80.8 0.1 1.3 0 0 0.3 0.2 0 0 3.6 0 0.3 0.6 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 3.2 0 0 0 0.4 0 0 0.3 0 0 0 2.6 0 0 0.3 0 0 0 0 0 1.8 0 0 0 0.3 0 0 0 0 0						

Total	129.9 102.4 158.8 94.5 94.3 691.6 172.7

1717

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1937 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
13	0 0 0 0 0 0 6.1 0 27 0.4 0 0 0 1.3 0.6 6 0 0.3 32.1 4.2 2.2 0.8 1.9						
14	0.7 0.9 0.1 0.2 8.9 3.7 2.3 2 2.3 1.6 0.9 19.8 8 34 23.8 8.7 13.4						
15	10.8 10.9 4.8 55.6 5.6 5.9 7.1 2.2 39.1 17.8 69.7 30.5 19.2 44.1						
16	31.6 32.8 31.6 96.1 39.1 23.5 94.9 37.7 55.6 32.1 61.5 48.9 36.5						
17	94.8 41.5 34.1 17.8 63 84.6 35.2 98.4 43.7 44.8 17 90.6 22.4 14.1						
18	14.6 10.6 78.3 36.8 35.6 58.1 36.9 73.9 36.3 36.1 22.8 43.6 38.1						
19	21.3 25.6 24.4 49.3 31.6 30.1 30.6 27.7 61.8 30 54 46.4 72.9 27.8						
20	33.9 43.1 28.1 65.4 67.8 58.2 116.7 87.6 88.8 85.9 17.9 54 11.6						
21	37.6 46.5 36.1 59.9 17.6 10.2 16.7 15.4 16.9 14 21.7 20.8 13.6 8.						
22	11.9 12.3 18.7 26.3 46.2 35.2 16.4 31 23.2 71.4 44.5 16.6 13.2 15						
23	8.5 13.1 45.8 17 29.5 21.7 15.7 22.2 29.5 8.4 19.2 65.9 71.7 12.3						
24	47.7 52.7 18.2 29.6 9.1 12.2 11.3 9.7 16.2 7.6 30.1						
25 26 27 28 29 30							

Total	762.3 571.4 856.2 713.3 564.4 914.5 636.4

1718

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1937 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	34.4	38.5	20.2	55.5	43.9	58.3	52.7
13	13.4	10.6	7.3	8.9	8.4	3.7	8.8
14	19.5	10.9	18.6	18.2	7.6	17.2	40.7
15	18.6	7.3	17.9	12.2	14.5	14.5	11.8
16	7.4	5.5	2	4.2	5.8	3.8	2.7
17	57.1	34.9	12.5	103	47.8	44.4	49.3
18	3.8	4.5	3.2	5.3	4.7	4.6	2.4
19	1.2	4.4	4.4	4.5	6	11.7	4
20	6.1	11.9	1.3	15.6	9.9	1.6	8.9
21	11.4	3.4	10.7	10.5	2.7	3.1	2.1
22	0.9	12.2	7.5	1.2	5.5	4.3	2.6
23	1.3	5.6	7	6.3	9.6	6.5	4.2
24	7.2	2	7.8	2.1	2.2	4.7	0.6
25	0.2	0					
26							
27							
28							
29							
30							
31							

Total	454.3 311.1 216.5 504.3 311.1 494.6 344.4

1719

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1937 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	19.5 14.8 14.7 18.3 13.5 5 10.5 57.8 36.4 20.9 15.3 38.3 43 22.9 35.8 31.6 48 39.1 41.9 18.4 41.1 46.5 25.8 77.1 27.9 26.1 101.9 51.1 41.6 40.3 14.5 65.6 50.1 76.7 84.5 5 1.5 15.3 6.7 2.5 7.5 5.5 0.5 0 1.1 2.1 0.7 1.4 0.9 13.2 10.4 7.2 4 13.1 9.5 9.4 12.9 21.4 13 80.3 41.3 13.9 36.8 7.5 9.3 6.1 29.1 22.2 1.8 21.4 5.9 4.1 4 18.5 1 3.9 6.1 2.2 1.6 3.1 1.1 1.7 2.7 0.2 5.8 5 0.6 8.5 6.6 0 2.6 0.9 0 0.4 0.8 0.1 0.6 0 0.4 0 0.2 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0.1 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0.2 0 0 0 0 0.3 0 0 0 0 0 1.2 5.7 1.1 11.5 5.1 0.7 6 12.2 5.4 0 8.4 4.8 1.5 11 0.2 0 0 0.2 0 0 0 0 0.4 4.7 11.5 4 0 4.5 3. 2.4 0.2 0.6 1.9 4.4 0.6 2.4 1.1 1.6 3.2 1.3 1.5 1.7						

Total	275.1 217.5 234.5 353.5 293.2 294.4 316.8

1720

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1937 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.9 0 0.4 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 2.6 0 1.3 0 3 0 0 0.6 0						

Total	0.9 3.3 0.4 0.8 3.2 0 1.3

1721

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1938 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1722

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1938 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0.5	0
17	0	0	0	0	0	0	0
18	0.4	0	0	11.9	0	8	6.2
19	0.1	0	0	0.1	0	0	0.3
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	4.4
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	1.9
18	0.7	3.3	0	0	0	0.3	0
19	0.8	0	0	5	0	0	2.9
20	0	0	0	0	0	0	0
21	0.3	2.1	0.1	0.2	0.3	0	2.9

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0.6
16	0	0	0	0	0	0	0.7
17	2.5	0.8	0.3	2.4			
18	0	0	0	2.3	0		
19	2.3	0.3	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0.6	1.7	0	0.2	0.6	0	2

Total	3.1 32.4 1.1 8.7 14.7 3.4 17.3

1723

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1938 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	12.2	2	34.5	4.3	2	20.1	4
12	20.4	49.1	29	22.1	65.6	22.1	27.8
13	10.1	7.7	10.9	10.2	18.5	13.1	23.7
14	42.5	21.4	32.4	30.8	25.2	20	40.9
15	48.4	37.1	36.1	35.2	53.3	26.6	70.9
16	77.9	72.3	23.6	68.2	86.1	72.3	83.8
17	36.5	75.4	77.8	17.5	103.4	77.3	35.2
18	22.8	45.4	25.6	21.1	9.7	16.9	19.8
19	34.4	37.2	46.9	51.5	15.1	29.9	36
20	41.9	57.1	80.7	82.3	9.3	96.2	76.7
21	49.7	17.1	7.5	26.1	1.3	17.4	19.5
22	15.3	16.9	13.8	20.8	28.2	17.7	20.9
23	50.6	26.4	31.7	2.8	29.7	32.6	11.9
24	11.4	13.5	13.4	14	13.6	13.4	11.8
25	32	31.2	35.5	49.3	40	39.6	50.9
26 27 28 29 30							

Date	74°15'E 15°45'N	73°45'E 16°E	74°E 16°E	74°15'E 16°E	73°45'E 16°15'N	74°E 16°15'N	74°15'E 16°15'N
1 2 3 4 5 6 7 8 9 10							
11	57.1	17.3	38.7				
12	8.6	49.6	26.9	69.8	37.7	11.9	
13	7.8	46.2	35.7	19.2	39.1	55	
14	16.8	54.3	11.6	7.9	39.3	12.8	73
15	47.8	43.3	41.8	42.2	53.4	38.3	
16	83.8	23.6	18.7	39	19.1	21.5	34.8
17	35.2	72.5	59.2	57.6	2.8	52.2	55.1
18	19.8	6.4	12.1	42.2	35	17.4	37.1
19	36	40.7	42	31.2	33	20.1	50.3
20	90.7	71.7	41.2	36.1	1.9	16.3	14
21	19.5	7.1	25.9	5.8	14.1	7.5	22.5
22	20.9	27.9	64.4	68.7	11.5	52.1	52
23	28.9	6.7	7.9	6.3	13.1	9.4	4.5
24	28.4	23.5	12.9	11.9	18.4	8.2	10.9
25	21.2	51.7	10.3	51	50.6	43	74.9
26 27 28 29 30							

Total	1114 1029.9 628.6 1061.3 958.1 1032 1011.4

1724

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1938 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	5.1 1.2 5.5 3.5 0.8 5.7 1.5 5.1 1.5 3.6 7.7 2.4 1.5 2.5 10.2 1.9 2.8 5.9 0.8 0 0 21 29.1 42.3 14.3 20.4 4.7 4.6 64.7 61.6 21.4 91.2 95. 27.8 43.7 10.7 0.5 25.5 4.4 0.5 1.5 0.3 27.8 8.9 63.1 21.8 8.1 13.7 13.1 53.8 46.3 37.4 40.9 31.7 60.2 26.9 30.4 17.6 25.1 27.6 18.3 16.9 14.6 31.1 20.1 11.7 23 15.4 7.2 12.6 17.9 18.1 3.9 40.7 25.1 1.9 19.5 16.8 5.2 12.8 11.2 7.7 5.9 6.3 27.5 34.6 13.1 58.3 41.2 38.7 39.9 17.6 24.7 12.3 41.9 32.5 29.9 43.4 31.3 21.3 29.2 28.6 21.3 26.9 22.2 16.8 11.5 24.9 23.8 11.8 18.3 16.2 23.8 15.9 2.8 9. 9.3 8.3 7.4 24.2 9.2 17.5 27.4 12.5 5.1 12.8 12.7 9.3 11.4 18.6 10. 2.8 8.7 4.9 4.8 3.4 8.3 6.4 16 16.4 7.6 3 5.3 7 3.8 7 3.7 36.1 19.9 37.9 40.7 23.8 38.1 23.1 33.2 26.1 33.5 62 32.4 70.5 44.6 29.8 17 19.8 37.6 19.6 27.7 24.1 48.1 33.1 8.6 27.4 20.9 30.8 25.4 21.8 23.3 9 14.8 12.6 9.9 23.5 23.2 29.9 1.8 16.3 24.6 6.3 21.3 12.7 10.1 9.6 7.6 7.7 3.9 16.4 9.7 11.3 2.9 10.7 12.4 8.3 11.5 9.2 5.5 6. 5.9 6.6 3.8 4.2 6.1 4.1 5.9 3.8 4.7 5 2.8						

Total	690.9 526.6 510.9 742.1 541 504.3 513.2

1725

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1938 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	29.5 30.4 17.2 55.3 41.7 37.2 60.1 12.9 6.9 29.7 43.4 18.7 20.7						
15	25.4 6.5 3.6 76.3 41.9 17.1 56.7 42.1 19.8 8.3 11 53.3 25.3 54.6 3						
16	32.2 24.7 6.7 15.6 18 9.5 17.5 35.3 47.1 8.9 9.7 26.5 6.4 15 14.1						
17	19.7 3 8.5 11.2 4.1 15.4 0 2.9 2.3 0.5 1.3 1.6 0.6 4.6 5.6 0 11.1 9.3						
18	0.3 4.3 0 0 0 1.6 0.6 1.7 1.1 0 0.1 0.8 3.2 1.1 0 1.3 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 1.6 0 0.7 1.5 0 0 0 1.4 0 0.6 1.3 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0.3 0 0.1 0.3 0 0 0 0.9 0 0.4 0.9 0 0 0 0.1 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.6 0 0.7 1.5 0 0 0 2.1 0 0.9 2 0 0						
22	0.8 0 0.3 0.7 0 0 0 0 0 0 0 0 0 0 0.4 0 0.2 0.4 0 0 0 1.1 0 0.5 1 0 1						
23	0.3 10.9 0 4.7 10.1 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	176.1 149.3 165 263.9 170.8 194 221.1

1726

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO							
Year -1938 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0.3 0.6 0 0 3.3 0						

Total	0.6 0 0.3 0.6 0 0 3.3

1727

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year -1939 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1728

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1939 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 2 0 3.1 2 0						
17	1.2 0 0 0 0 0 0 0 0.1 6.5 0 1.6 1.4 0 0.6 0 0 0 0 0 0 0 0 0 0.7 0 0 0						
18	0 1.6 1.5 0 3.4 2.2 1.9 2.6 1.9 0.8 0.5 2.1 1 0.2 0.8 0 0 0 0 0 0 0 0						
19	0.6 0 0 0.2 0 0 0 1.1 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0.7 0.1 0 0 0 0 0 0 0.8 0 0 0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	5.8 10.8 2.9 10.2 6.6 3.8 6.1

1729

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1939 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	0	0	0	0	0	0	0
12	6.9	0.9	9.5	9.3	12.2	27.1	15.9
13	9.1	13.4	44.2	6.4	6.3	16.8	4.5
14	27.1	12.6	8.3	25.8	8.1	42.8	33.4
15	42.8	29.7	19.7	35.2	22.1	54.1	29
16	115.4	30	105.2	89.7	121.2	88.3	45.4
17	153.6	42.6	48.9	16.9	41.3	59.8	83.4
18	9.8	40.7	20.8	26.2	24.9	18.5	11.4
19	36.9	30.5	41.2	26	6	12.6	14.1
20	10.8	26.9	22.9	4.8	29.1	26.6	20
21	20.7	5.3	6.1	2.3	15.3	11.6	18.3
22	23.8	61.1	28.1	29.6	31.3	19.8	22.1
23	29.8	48.4	68.7	20.8	18	22.6	11.7
24	36.7	18.2	27.9	20.2	19.4	60.4	34
25	34.4	23.5					
26							
27							
28							
29							
30							

Total	906.4 699.3 587.7 930.6 792.3 957.9 830.2

1730

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1939 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	6.4 5.3 2.8 5.3 2.5 4.1 2.9 11.4 2.3 4.6 9.9 2.4 3.2 5.2 16 6.3 4.3 7 3.7 5.6 3.4 27.6 16.2 9.9 18.1 15 13.6 13.4 60.5 29.5 7.2 10.6 12 13.1 6.1 72 40.7 4 70.2 43.4 7.5 30.6 15.6 6 2.1 23.3 8.8 1.8 8 2.7 3.4 0 6.8 5.3 0.9 2.9 16.2 19.9 0.5 3.3 19.3 2.6 0.7 16.2 10.9 13.7 4.1 7.1 5.1 0.7 5 2.2 2.8 5.5 1.5 2.4 0.9 10 2.1 12.1 7.5 2.8 4.9 0.9 11 5 7.8 31.2 11.9 9.7 16.5 39.9 46.8 23.9 107.9 62 15.8 42.2 59.8 43.8 73.3 52.6 45.1 61.5 38.5 56 74.1 36 43.7 43.3 109.5 46.2 40 43.7 30.3 73.6 59.7 98.3 71.4 17.1 46.5 3.4 96.5 80.8 64.2 118.9 9.4 15.4 9.3 11.3 25.6 24.8 44.9 15 34.3 9.9 47.2 50.2 69.4 120.3 16.3 38.7 14.3 56.8 52 55.4 88 18.5 54.4 8.3 55.1 42.6 36.5 40.7 27.4 53.7 12.3 66.4 49.3 62.5 51 46.8 20.8 104 25.4 15.7 48.7 29 106 108.9 34.8 169.2 122.4 145.9 132.6 28.9 35.9 9.1 61.5 54.2 55.4 60 11.6 13.1 19.7 29.6 25.6 25.4 27.7 29.9 35.7 25.9 30.1 40 32.4 33.5 57.1 49.7 71.4 52.7 83.5 104 88.7 139.2 126.2 17.6 78. 72.9 47 58.2 22.4 25.1 8.3 16.8 22.8 8.3 19						

Total	1012.4 1016.6 583.6 1278.4 1083.7 1139.5 1203.4

1731

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1939 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 0.3 0.4 0.9 0 0.3 0 0.3 0 0.1 0.3 0 0 0 0.3 0 0.1 0.3 0 0 0 0.2 0 0 0.2 0 0 0 0.7 0 0.3 0.7 0 0 0 3.4 1.4 1.5 3.1 0.2 0 0 2.7 7.1 1.1 2.5 0 0 3.6 5.5 0.2 4.2 3.3 0 1.4 0.3 0.2 0.1 5.8 1.9 0 2.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 2.6 1.8 7.8 0 12.6 5.3 0 7.2 13.9 11.9 3.6 4.5 11.4 1.5 6.8 11.3 16.3 2.8 17.9 15.6 4.6 7.3 12.7 6.6 3.3 0.7 3. 0.4 0.1 17.4 6.6 5.6 3 3.8 0.3 1.1 2.5 14.3 3.8 1.4 5.1 8.6 7 1.7 1.3 0 1.2 5.9 4 6.2 8.9 5.4 2.2 2.2 5.6 6.1 3.5 44.6 25.1 27.3 3.9 16 18.7 5 11.5 7.8 19.8 6.3 6.1 35 7 50 56.8 30 50.1 40.8 12.8 24.8 1 8 3.1 26.7 11.8 2.8 20.4 4.4 5.3 0 1.3 5.6 12.7 9.4 5.7 1.9 0 5.9 4. 0 3.8 5.3 6.8 0 0.9 6.6 0.8 0.2 20.2 6.9 0 0.2 0.4 0.3 0.4 0 0 0 0 0 1.5 0.4 1.4 0 12.4 0 0 1.9 0 1.7 10.2 1 0.5 3 0.4 0.2						

Total	239 213.5 118.8 157.3 157.2 112.7 116.9

1732

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year -1939 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0.2 0						

Total	0.2 0 0 0.2 0 0 0

1733

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1940 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 4 0.6 0 0 0 0 0 4.1 0.6 0						

Total	0 0 0.1 0 0 8.2 1.2

1734

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1940 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	9.4	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0.7	0
20	0	1.8	0	6.4	2.4	0	4.9
21	0.4	0	0.1	1.9	7.9	0.2	11.8
22 23 24 25 26 27 28 29 30							

Total	2.1 20.7 0.2 18.5 13.2 0.7 27.7

1735

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - IX

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – IX

Sl. No.

1.

D E S C R I P T I O N

Decision and findings by the Tribunal on

important questions contd…

DailyRainfall Data for the period

from June, 1940 to May, 1976

1736 - 1952

PAGE NOS

DAILY RAINFALL DATA

FOR THE PERIOD

FROM JUNE 1940 to MAY 1976

1736

Year 1940 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0.4 0 0.2 0.4 0 0 0 0.2 0 0.3 0.1 0 0.1 0 2.5 0 65.3 0. 2.7 41.1 5.1 15.3 4.4 27.8 12.9 5.5 35.4 18.1 8.7 9 4.1 19.7 12.1 14.3 10.2 0.4 0.5 0 0 0.5 1 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 24.9 8.2 0 0 0 0 1.3 1.9 0 8 4.3 0.7 3 2.3 1.5 2.2 0.3 1.5 5 1.4 1.1 1.5 0.5 1 1.8 0.2 0.5 0 0 0 0 0 0 0 4.6 0.1 19.3 0.3 0.1 8 0.2 38.9 10.3 35.8 8.8 6.7 8.5 3 20.6 5.2 24.4 31.8 13.8 8.6 27.7 22.8 3.1 75.3 3.1 3. 42.5 4.8 63.2 33.3 41 66.1 35.5 90.5 41.2 31.6 19.2 50.1 28.7 22. 60.3 27.1 19.9 12 64.8 14.2 9.6 32 10.9 76.6 42.9 51.5 42.5 31.4 71.3 25.8 73 58.3 22.6 51.1 44.9 81 43.1 37.8 21 72.4 17.8 17 19 17.9 60 55.7 37.2 63.8 50.5 54.4 73.2 43.6 80.8 7.8 48.8 88.1 50. 74.4 19.9 51.5 17 10.3 61.8 24 53.1 25.9 42.8 6.8 23.1 46.7 42.7 67.8 16.7 25.1 7.8 20 24.9 6.5 39.5 19.2 25.7 7.2 25.9 20 18.7 25						
Total	631.4 514 641.4 499.5 504.6 717.1 574.2						



1737

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1940 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	8.2	7.5	3.8	4.2	7.6	56.9	13.7
12	119.2	80.8	58.6	59.3	54.6	48.7	43.7
13	99.7	28	13.8	22.7	17.2	8.8	9.6
14	23.8	36.1	17.6	11.3	6.5	10.3	23.4
15	30.8	44.1	13.9	55	36.6	18	35.5
16	15.7	84.4	40.1	64.9	37.1	24.7	83.1
17	14.6	65.6	57.9	22.4	32.1	42	20.1
18	18.8	28.7	95	55.2	100.2	48.6	46.7
19	85.7	102.7	81.4	40	38.8	13.8	54.4
20	32.2	19.8	19.9	16.9	97	65.8	52.6
21	93.6	48.1	43.4	72.7	66.8	85.3	69.8
22	66.6	26.5	35.1	27.9	13.5	41	34.5
23	34.4	38.3	46.7	40.9	49.8	52	54.5
24	60.6	47.4	27.1	61.4	38.6	28	32.6
25	27.7	31.7	33.2	7	34.2	34.6	19.9
26	2.9	11.7	5.4	7.9	8	4.1	3.1
27							
28							
29							
30							
31							

Total	1600.2 1187.2 1123.9 1266.6 978.4 1483.9 1085.4

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1940 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.9 1.1 0 1.3 1.5 0 0.5 1.2 0.2 0.5 7.8 2.3 0.1 2.6 0.8 0 0.3 0.7 0 0 0.5 0 0.2 0.4 0 0 0 0.4 0 0.2 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 4.2 0.6 0 0.5 0 17.5 12.5 20.8 3.1 8.6 8.2 9.1 2.1 5.5 3.5 7 5.7 34.5 25.2 8.2 10 3.4 2.7 9.7 2.4 0.7 7.8 18.5 0.1 5.6 18.2 15.1 10. 1.8 5 0 5.8 3.3 1.8 2.6 1.3 0.8 11.2 2.2 5 9.6 8.7 8.8 2.7 12.3 0.6 1 6.5 3.4 10.2 12.1 3.6 10.9 8.8 8.6 12.4 2.6 1.5 11.9 1.5 1 3.3 3.3 1 4.8 13.3 9.5 6.3 9.7 7.6 8.2 4 2.5 5.2 3.5 9 5.8 3.2 5.6 10.6 1.8 0.9 5.3 11 0 3.3 0 0 0.4 0.2 0 0.7 0.5 1 0.6 9.2 0.5 0.2 19.2 12.8 0 12. 12.7 18.5 7.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0.7 10.2 0 0 4.6 0 10. 8.5 0.8 1.8 2.4 5.4 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0						

Total	120.5 110.8 110.6 82 101 143.8 113.2

1739

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1940 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 1 0 0.4 0.9 0 0 0 1.2 0 0.5 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0.3 0.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	3 0.3 1.2 2.7 0 0 0

1740

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1941 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0.5 0.3 0.2 0.1 3.2 0 0 0 0.1 0 2.3 0.8 0.7 1 0						

Total	0.5 0.4 0.2 2.4 4 0.7 1

1741

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1941 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0.6	0	0.7	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	3.1	11.7	0	0.3	2.5	1.6
22 23 24 25 26 27 28 29 30							

Total	3.2 18.8 1.4 2.2 7.8 2.6 3.8

1742

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1941 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 3.1 0 0 0.6 0 1.2 0 1.3 0.1 0 0.8 0 13.3 0.5 58.7 5.3 1.5 17.6 2 82.7 50.6 80.4 40.8 26 25.9 20.3 59.7 19.5 54 34 16.5 78.4 38.9 85.7 52.3 73.5 100.1 50.2 82.1 64.9 102.1 79.4 46.5 73.2 61.8 84 84.5 30 126.4 15.4 17.4 56.2 69.1 70.2 40.3 45 8.6 74.5 39.7 15.5 53.3 20.4 15.1 5.3 11.2 8 2.8 6.3 9.7 3.5 1.3 9.3 3.8 8.1 4.4 3.8 2.5 22.9 10.9 4 12.6 10.1 25.9 21.4 1 40.4 17.8 2.6 29.7 18.6 4.5 74 0.7 1.7 9.6 1.7 13.5 4 28.5 10.6 4.1 19.7 8.7 9.3 1.3 53.3 14.3 4.2 10 6.2 18.2 3.4 64.3 10 3.1 34.8 10 20.6 17.4 12.5 47.3 22.3 12.3 29.9 8.2 3.3 7.4 2.5 1 4.8 1.8 16.5 4 4 11 2.7 13.8 4.5 7.2 1.2 5.3 3.5 0.7 3.5 1 19.8 5.8 6.2 12.7 6 19.9 10.8 14.6 6 24.1 11.7 6.5 7 7.3 16.3 9.1 33 1.6 2.4 9.1 4.8 8.7 5.6 15.3 17.9 6.5 10.2 12.7 22.5 5.8 24.2 19.4 9.1 17.9 17 73.7 35.9 23.4 80.4 36.2 43.6 42 50.6 35.5 51.3 67 47.5 60.7 69.3 122.2 117 66.3 105.8 71.9 100.4 77.5 92.3 74 5.9 101.8 69.7 26.6 65						

Total	1007.6 750 871 935.4 581.1 804.2 754.8

1743

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1941 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	13.9 5.4 2.5 8.8 6 5.2 5.2 8.2 3.8 9.5 7.6 3.2 5.7 3.8 10 6 65.8 11. 4.8 17 11.6 32.4 14 32.6 22.5 14.4 48.3 21.3 62.4 47.5 18.6 67.2 40.1 20 47.6 26.8 16.6 5.8 18.5 12.5 3.9 13.5 19.6 13.8 3.1 37.8 17.9 10.8 25.1 5.3 12.4 9 23.2 12.8 11.5 20.8 24.9 71.8 9.8 104.7 52.7 46.5 64.4 15.4 45.1 24.1 35.5 37 13.1 30.8 46.8 56 8.4 36.3 50.7 15.7 34.9 15.5 33.1 1.4 27.9 20.7 5.4 19.6 4.9 7.5 3.7 4.4 7.5 1.4 3.8 7 6 0.7 26 10.8 0.9 13.9 4.5 5 2.2 3.8 5.6 4.6 8.8 7.4 5.1 13.1 3.5 3.7 3.4 6.4 46.6 35.3 5.3 27.3 21.6 2.9 13.1 3.7 4.8 5.3 5 5.3 3.5 8.3 12.3 23.5 4.3 24.8 19.3 5.7 35 9.8 6.3 1.6 6.3 4.2 18.9 19.6 11.1 6.6 5 19.2 9.2 4.3 13 14.7 11 2.7 7.9 7 3.5 5.7 19.1 8 3.9 6.6 5 3.7 5.9 8.1 4.8 8.6 4.7 3 4 3.7 8.7 4.8 0.4 5.8 3.5 1.8 3.2 0.7 2.6 0.4 0.5 1.8 4.3 1.3 0 0 0 0 0 1.6 0.3 0 0.1 0 2.8 0.9 0 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0.5 0.2 0 0.2						

Total	440 456.9 247.8 550.8 381.4 267.6 441.9

1744

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1941 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.7 0.5 2.9 0 3.3 2.9 2.6 0.7 0 0.3 0 0 0.2 0 20.6 10.5 0 17.5 35.6 14.4 18.3 1.4 6.3 0.3 0.1 1.3 0.2 3.6 5.1 4.2 3.2 0.9 4.1 2.8 8.7 18 30.9 9.5 23.4 48.7 18.7 23.3 1.6 3.4 0.5 18 6.6 9.9 10.1 0.7 0.2 0 0.3 0.4 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 2.8 5 27.3 0 2.2 6.2 6.3 1.9 2.4 3.4 0 69.8 26.2 0 28.5 0.2 0.9 11.3 18.9 8.3 10.7 8.7 0.9 4.5 0 9.5 4 0 6.4 0 3.1 0 0 0.6 0.9 0.3 0 0 0 0 0 0 0 3.5 1.1 0 0 0.4 0 0 0 0 0 0 0 0 0.1 4.9 0 0 1 0 0 1 8 0 0 1.6 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	63.4 109.2 28 160.6 148.3 67.2 115.3

1745

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1941 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0.2 0 0.9 4.6 13.4 0.3 3.5 2. 0.1 22.3 88.4 2.7 18.4 34.2 18.1 16.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0.2 0 0 0 0 1.8 1.3 2 11.7 0 0 2. 0.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	25.4 104.7 16.4 18.7 40.1 23.5 18.8

1746

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1942 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.7 0 0 0.5 0						

Total	0 2.7 0 0 0.5 0 0

1747

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1942 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0 2 0 0 0 0 0 0 0 0 2.4 0 0 0.5 0 6.9 0 0 0 0 0 0 5.5 0 4.7 0 0 0.9 0 0 0 0.8 0 0.9 0.5 0 0.4 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 1.9 0.6 0 0.7 0 0 0 0 0 0 0 0 0 0 0 1.2 0.4 0 1.5 0.3 0.2 0.4 0.5 0 0 0 0.6 0 0 0.1 0 0 0.2 0.4 0 0 0 0 0 4.9 2.5 14.9 1.5 1.6 0.9 0.5 11.9 8.6 4.2 7.7 6.3 6.1 3.7 0 0 0 0 0 0.6 0 0 0 0 0.9 0. 0 0.4 1.4 0.4 0 0 0.1 0 0						

Total	19.9 20.7 21.4 13.3 12.6 8.1 20.9

1748

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1942 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45

1 2	
3 4	
5 6	
7 8	
9 10	
11	
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0.3
13	0.3 0 0 0 0 0 0 0 0.2 0 8.6 0 0 1.3 0 6 1.2 3.6 3.4 3.5 0 0.6 5.3 0
14	12.3 0.6 0 1 0 10 10.7 10 14 7.3 26.7 8.3 39.7 8.1 142 10.4 9.3
15	41.6 30.4 156.1 65 96.3 149.5 85.3 155.1 109.4 110.6 69.1 68.6
16	87.1 61 102 73 70.6 43 50.7 52.3 40.9 71.8 44.4 17.3 7.1 15.3 10
17	5.8 48.3 12.9 5.1 1.5 24.9 10.6 4.9 24.9 9.5 19.8 7.9 5.1 12 12.2
18	8.8 6.3 6.1 2.4 47.7 10.1 3.6 6.5 4.5 69.2 25.9 75.1 13.9 11.5 35.7
19	9.5 124.7 49.1 67.9 20.4 15.8 80.2 16.4 51.4 17.3 20.1 13.1 9.1
20	29.9 11.6 5.7 5.6 2.8 10.3 4.3 7.2 6.8 22.8 9.2 15.3 13.6 7.4 14.3
21	12.5 33.2 11.2 89.6 14.9 9.1 48.7 13 110.5 47.6 58.8 19.1 16.8 93
22	25.1 114.5 44.8 79 54.3 30.4 83.3 42.6 127.5 64.2 111.2 66.5 42.3
23	109.2 45.7 160.4 76.3 61.2 107.8 69.9 121 90.4 162 84.8 171.1
24	75.8 54.5 117.9 60 196.6 121.2 158.9 160.8 98 120.2 89.8
25	
26	
27	
28	
29	
30	

Total	1625.3 773.2 1396.1 931.9 603.2 1349.4 723

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1942 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	19.1 41.8 19.7 19.7 28.8 14.2 33.6 10.7 10 10.4 34.7 19.6 13.9 34.9 22.6 29.1 12.3 24.8 22.6 21.6 33 8.3 24.1 5.1 37.7 27.5 12.7 35.6 6.1 25.3 5.4 17.1 22.5 7 35.3 21.5 14.5 26.1 13.7 13.8 11.2 9 20.3 13.5 10 11.7 9.6 9.9 8.2 8.3 4.3 8.4 11.3 5.8 10.2 6.4 6.1 2.8 10.3 6.6 2.6 7.8 4.5 10.7 7.2 3.3 8.3 5.5 9 10.7 8.3 1.5 48.4 3.9 2 6.6 2.9 72.3 40.3 19.6 46.8 29.2 42.2 34 20.5 35.1 4.7 35.7 30.9 27.8 43.2 39.9 19.8 9.8 12.6 13.4 28.7 22.4 13.1 6 9 6.1 3.8 3.7 6 27.1 11.1 7 6.8 5.3 7.4 4.8 32.5 16 68.2 17.1 10.2 18 13.4 23.2 18 49.7 24.6 14.5 63.6 28 13.5 4.9 4.5 17.5 7.6 25.4 13.3 2.7 1.5 7.1 4.9 1.9 8.9 3.9 9.3 3.1 15 10.7 4 4 5.6 40.7 10.3 54.9 9 6.4 30.7 7 54.8 38 61.5 73.2 38.3 56.3 37.7 40 24.3 11.9 38.9 19.9 11.6 18.3 10.9 3.2 65.4 10.7 3.8 16.3 4.8 54.1 19.1 18.7 36 15.4 7.1 13.9 23.9 8.1 9.9 14 6.7 9.2 7.7 18.5 7.6 16.6 7.9 4.2 3.4 3.8 24.6 17.4 13.9 20.6 10 25.7 18.5 20.6 18.3 26.2 31.9 20.6 20 33.3 58.6 26.1 26.1 35.9 20.1 20.2 29.1						

Total	742.8 503.2 659.1 650.4 426.5 554.3 563.9

1750

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1942: Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.7 0.5 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 21.4 0 0 2.3 0 10 3.2 8.2 14.9 4 22.8 10.7 11 5.8 7 12.5 5.6 5.8 9 22.1 47.5 13.6 19.3 15.7 24.6 28 21.4 15.4 12.8 35.8 14.2 10.6 18.6 32.6 11.1 2.9 25.4 11.1 10.5 15.7 7.9 2.4 5.4 2.3 0.9 13.5 2.4 0.9 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 11.6 0 0.5 2.4 0.5 2.7 1.7 0.5 0 0 0.2 0 0 0 0 0 1.4 0.9 2.5 1.3						

Total	109.8 98.3 71.3 112.1 55.5 93.1 88.9

1751

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1942 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.3 0 1.7 1.8 0 28.3 11.7 1.6 13.5 2 8.4 0 18.7 10.3 0 14.9 0 4.7 0 0 0.9 0 1. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	3.7 14.9 0 47 22.9 1.9 29.6

1752

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1943 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1753

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1943 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	3.3	0
18	0	0	0	0	0	0	0
19	0	0	0.2	0	0	0.3	0.1
20	0	0	0	0	0.4	0.7	0
21	4.5	0	0	0	0	0.1	0
22							
23							
24							
25							
26							
27							
28							
29							
30							

Total	0.3 25.7 0.9 0 13.5 0 1.3

1754

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1943 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	11.2	5.7	1.1	9.1	4.6	10.1	4.5
12	7.3	2.4	26	5.6	18.5	10.1	5
13	9.1	2.2	6	15.3	6.4	28	9.1
14	3.7	11.2	3.8	36.1	13.8	69.6	14.8
15	81.2	35.9	31	17.1	22.3	13.5	8
16	70.7	35.3	55	155.8	67	66.7	84.2
17	6.2	20.1	10.9	14	18.4	16.4	33.5
18	20.4	36	16.7	11	39.2	14.5	76.9
19	14	6.1	16.3	10	17.1	20.7	20
20	11.6	7.7	8.6	16.2	11	7.2	6.9
21	7.9	11.7	7.5	15.1	6.1	41.1	10.3
22	56	23.8	58.7	20.2	31.6	44.6	15.4
23	80.3	29.6	56.7	12.8	32.5	22.6	6
24	30.1	139.6	66.9	76.2	54.7	42.2	100.6
25							
26							
27							
28							
29							
30							

Total	1017.3 470.9 909.4 839.3 427.3 956.5 580.7

1755

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1943 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.2	12.9	6.8	12.9	14.1	10.5	12.1
13	36.1	17.9	9.9	37.3	18.6	11.2	18.9
14	13.9	20.9	28.7	7.1	32.7	22.2	15.8
15	20.9	9.7	11.4	5.8	31	18.2	7.3
16	8.4	9.4	1.8	2.7	5.6	8.9	11.3
17	0.8	1.6	2.2	2.6	0.9	3.7	0.4
18	4.9	4.8	2.9	3.2	7.7	5.6	2.6
19	6.4	5.3	5.9	2.8	1.6	2.7	5
20	5.3	14.8	3.1	18.9	12.1	6.8	18.3
21	2.2	1.7	4.9	3.8	0.9	1.7	4
22	0.8	6	3.5	6.4	5	1.1	0.2
23	4.2	2.2	1.1	2.8	2.9	23.2	9.9
24	4.7	2.1	2.7	1.5	24	7.5	49.7
25	84.8	17.8					
26 27 28 29 30 31							

Total	289.9 206.4 214.8 334.5 209.2 311 307.2

1756

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1943 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	 0 0.8 0 1.7 8.2 0 0.6 10.7 6.1 0 7.9 6 15.7 26.5 0 0.2 0 4.7 5 3.1 8 26.7 28.8 2.9 1.1 11 4 9.7 5.3 24.1 15.6 5.1 18.9 6.2 12.7 10.5 15. 25 5 12.4 17.7 13.4 43.2 23 8.7 2.5 10.6 25.9 11.2 27.6 16.5 2.1 12.5 8.3 5.7 19 5.1 2 0.2 4.9 2.1 4.6 2.5 9.4 2.1 26.3 2.6 9.2 5 1.1 38.2 21.9 12.3 5.4 13.3 3.5 7.1 9.2 13 0.9 2.9 3.8 4.2 10.6 0 0.5 0 3.3 1.2 0.7 1.5 3.4 1.7 1.1 3.8 2.3 0 1.3 7.6 3 3.6 1.5 17.5 4.4 15.1 4.4 2.4 3.1 0.7 6.4 8 3.5 18.5 13.9 3.5 8.5 5.7 13.4 11.4 7.1 3.3 6. 8.3 3.4 4.9 3.8 1.5 1 0 4.9 3.2 8.1 6 0.8 1.2 0.1 3.6 3.6 6.5 3.2 48. 35.5 0.5 5 10.3 0.4 1.6 1.2 2.5 1 3.4 1.6 20.2 5.2 2.6 6 1.8 5.1 7 2 2.1 69.3 62.8 0 8.8 17.6 30 16.7 0.2 0.1 12.8 2.3 0.8 2.4 0.9 6.7 5 0 0 1.4 2.8 0.5 0 0.4 0 0 0 0 0 0 1.8 0 0 0.3 4.8 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	358 296.1 129.2 115.5 191.1 204.7 196.6

1757

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1943 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1758

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1944 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0.2 0 0 0 0 0

1759

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1944 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	15.
19	0	0	3	0	0	0	2.1
20	0	0	0	0	0	0	0
21	0	0.5	0	0			
22							
23							
24							
25							
26							
27							
28							
29							
30							

Total	0.5 20.2 0.4 0 4.3 0.3 0

1760

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1944 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	3.1 1.4 3.5 10.5 3.8 3.7 4.7 0.6 0.2 13.2 3 0.9 5.5 1.3 19.4 5.1 32 11.9 4.5 15.3 4.8 44 19.1 9.3 29.6 13 41.9 17.7 0.9 0.2 0.6 5 1.7 9 10.5 1 0.3 0 0 0.1 0 0 8 1 39 0.5 0.3 4.3 0 21.9 4.2 33.3 4.9 1 23.9 3.1 14.7 5.2 8.8 31.8 10.9 22.7 16.2 2.6 1.3 26.2 9.7 3.4 8.3 4.8 14.9 4.6 72.1 13.2 4.2 23.8 6.3 35.5 23.3 37.3 13.9 8.1 46.6 8.9 65.2 22.4 53.9 41.9 24.9 63.1 29.4 62.4 39.2 72.8 60.3 38.9 117.7 76.2 61 42.8 26.9 123.4 74.2 72 96.8 80.3 52.7 33.4 58 43.8 37 61.6 27.7 29 6.5 49.7 29 73.4 45.3 7.2 4.2 21.8 4.4 2.5 9.1 3.4 62 22.7 14.5 46 20.7 34.2 20.6 12 6.9 2.9 13.1 6.8 11.2 9.4 11.3 14.2 68.9 36 15.4 12.4 17.6 55.3 42.8 9.3 25.4 24.9 35.6 29.5 0.7 3.1 1.5 7.1 3 1 2.7 10.5 1 18.1 0.8 0.3 2.1 0 6.8 3 1.2 33 11.4 9.8 14.3 54.5 17.6 4.9 6 7 6.2 3.8 11.3 2.8 3 10.7 3.9 37.5 12.8 85.6 40.9 1 66 31.4 38.9 34.1 73.2 29 18.3 60.3 28.2 9.5 28.1 25.1 7.9 6 11.1 5.6 24.1 7.7						

Total	879.5 448.1 640.7 787.2 423.8 800.7 571.6

1761

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1944 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	35.5	42.6	21.7	27.2	42.3	31.1	40.2 57.6 29.1 12.8 45.7 24.1 59
13	48.5	28	10.2	5.4	12.9	7.5	14.5 9.8 6.6 4.4 1.3 4.4 2.8 2.1 2.7 1.7
14	6.1	0.1	3.4	3.3	1.2	3	0.2 1.2 2.1 1.9 1.3 1.5 1.6 2.5 0.8 1.5 2 0.8 4
15	3.8	4.2	4.8	4	8.5	5.2	2.7 3.9 5.1 6.3 2.8 8.3 5.8 5.4 7.5 7.7 4.6 7.4
16	5.7	4.1	3.8	4.9	15.5	6.3	2 4.6 2.8 6.4 3.2 2.9 1.2 2.8 4.7 1.6 4.2 2.
17	4.2	2.2	1.1	1.9	0.9	3.3	1.3 0.2 0.6 0.9 6.1 2.1 1.7 2.6 4.3 6.5 11.6
18	54.9	19.4	15.4	27	32.9	32.4	28.5 46.3 27.8 53.6 41.8 21.9 36.9 15
19	37.8	25	34.3	31.3	60.8	52.3	19.2 32.7 37.8 29.2 30.9 22.3 12 31.3
20	9.1	9.5	18.5	20.5	75.4	55.1	15.9 46.8 36.2 17.9 39.5 47.7 32.5 10
21	7.8	15.5	22.7	18.3	29.2	17.9	5.8 1.1 8.2 50.2 21.8 5.2 6.9 4.7 1.7
22	7.4	16.7	12.8	5.9	6.7	3	2.2 5.7 16.4 11.7 11.4 4 11.6 0.5 10.5 10.3
23	11.9	18.7	9.1	8	0.7	6.5	8.2 7.2 11 8.5 9.1 0.7 6.8 10.1 4.7 4 4.6 4.3
24	0.3	3.5	4.9	4.5	6.3	7.6	2.6 0.5 2.3 4.2 1.6 0 1.6 0.6 0 0.3 2.4 0.8 0
25	0.6	0.9	0	0.1	0.6	0.3	
26 27 28 29 30 31							

Total	528.9 415.6 248.2 380.4 327.1 457.1 422.1

1762

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1944 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	2.8 0.9 0 0 2.2 0.3 0 34.2 14.4 23.2 0.5 4.2 4.3 0.2 5.3 24 10.6 4.1 5.6 12.9 6.5 1.4 0 2.4 0.2 0 0 0 0.8 15.5 0.3 15.6 10.8 0 5.9 11.9 3 0 0.2 1.2 0 0 0 0 0 0 0 0 0 0 0 0 7.5 0 0 0 8.1 2.3 0 17.8 0.9 0 7 10.8 0.1 15.4 10.5 9.9 22.9 2.3 0.3 0.9 0 0.1 0 12.8 4.9 3.3 0.6 23 10.5 0.4 10.9 0 0 0 1.4 5.8 3.5 1.5 6.6 1.9 0.5 9.6 3.4 0.8 4.3 17.9 0.8 1.6 1.3 0 0 0 0 0 0 0 0 0 0 0 0 1.8 0 0 0 2.7 24 0 2.8 3.2 0 5. 19.3 2.5 36.1 21 25.1 25 5.5 4.4 3.3 0.3 1 0 15.4 9 3.2 0 0.1 4.1 5 1.4 14.1 20.9 0 3 5.6 0.5 1.2 0.4 0.4 0 0 3.8 2.1 0.5 3.2 0.7 4.6 1 9.8 0.6 1.8 11.8 5 32.2 16.9 9.9 13.5 11.7 24.4 7.2 14.4 12.7 6.5 24.4 13 18.2 8.6 9.5 16.8 11.4 0.9 6.2 14.3 13.2 2 42 16.3 51.4 36 0 0 0 0 1.4 0 0.9 8.6 2.7 0.3 0.1 0.9 0 0 1 0.4 0 2.1 0.8 0 3.1						

Total	210.8 176.7 134.5 202.8 178 159.7 182

1763

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1944 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1764

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1945 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1765

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1945 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0.9	0	0.2	
16	0	0	0	0	0	0	
17	0	0	0	0	0	0	
18	0	0	3.2	0	1.7	4.1	
19	0	0	4.7	0	0.9	0	
20	0	0	0	0	0	0	
21	0.4	0	0	0	0	0	
22 23 24 25 26 27 28 29 30							

Total	4.5 6.8 1.9 0.4 11.6 0.1 0

1766

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1945 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	9.3 3.6 11.8 18.7 10.9 2.4 21.7 0 29 2.7 0.7 6.8 16.4 3.8 0 0 0 0 0 0 0 1.1 0 0 0.2 0 0 0 0 10.7 0 0.7 0.9 0 11.8 4 7.2 34.7 11.2 12.5 14.8 10.6 3.9 13.3 0.5 1.7 8 1.1 1.2 0.5 1.4 3.1 1.1 5.9 4.1 1.8 0 4 1.3 0.4 0.5 0.5 5.7 6.7 37.3 131.8 44.5 6.1 49.8 62 18.2 112.7 11.1 10.5 36.3 6.9 97.5 39.2 162 66.9 31.7 106.7 46.5 118.9 50.3 102 87.7 46 124.1 61.4 96.6 53.5 21.8 84.2 54.8 57.9 55.9 22.6 26.1 2.6 20.6 27.6 16.6 24.4 3 5.3 14.1 4.7 13.5 14.7 17.9 19.8 9.6 10.1 8.1 6.4 6.6 9 22.7 9.9 61.4 26.8 13 46.2 20.7 67.8 25.5 44.9 62.8 32.3 89.2 43.1 96.8 45.7 27.4 80.9 45.7 102 56.3 36.7 24.7 40.2 60.2 28.7 62.4 40.1 30.5 15.2 31.5 25.2 13.7 38.3 18.6 48.7 24.9 59.7 65.8 30 68 57.8 64.8 31.5 15.2 52.3 31.3 39.8 36 24.5 22.3 6.8 37.9 22.2 20.8 30.5 11.3 6.8 0.4 13.8 10.8 19.5 18.1 6.3 4.9 6.1 5.5 6.3 1.7 4.6 6.1 3.8 4.1 6.4 5.3 7.9 6.1 19.2 8.8 15.9 5 4.8 9.2 6.8 47.6 19 20.3 35.8 17.3 25.5 23						

Total	943.8 494 848.7 952.5 529.4 946.1 679.5

1767

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1945 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	1.1	0.2	1.9	4.1	1.3	3	2.7
12	59.7	29.6	13.6	48.3	18.4	31.1	11.5
13	12.2	29.5	36.2	13.5	37.4	18.8	12.7
14	11.9	9.3	3.7	23.6	8.3	22	8.4
15	205.6	72.9	6	78.1	5.3	4.2	10.1
16	23.2	7.6	9.3	4.9	6.3	27.3	24.8
17	17.7	40	59.7	42.2	7.8	35.1	58
18	25.2	29.2	8.2	10.2	15.7	18.9	13.6
19	12.2	10.4	10.8	13.5	17.4	10.7	55.3
20	35.4	55.3	8.3	57	8.6	14.2	5.9
21	18.3	14.6	14.2	14.9	12.7	2.4	10.2
22	7.3	10.5	9.3	16.3	11.7	2.3	5.3
23	11.6	7.8	4.4	2.1	6.9	4.5	10.3
24	4.9	11.1	6.2	3.3	11.7	8.1	20.4
25	5.6	22.1	9	5.2	11	12.7	6.4
26							
27							
28							
29							
30							
31							

Total	578.7 393.4 386.5 773.4 538.8 507.9 629.7

1768

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1945 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 5.1 0 8.7 3.9 0 6.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0.3 0 0 0 0.3 0 0.9 0.4 0.1 6.4 4.6 0 13.9 2 0.6 1.7 0 1.6 15.3 5.8 0 0 2.5 0 0.5 15.1 2.5 4.1 1.2 2.8 5 1.7 1.3 1.9 5.2 6.1 3.3 18.8 10.3 4.2 8 3.2 1.7 3.8 0.9 1.3 11.8 2.7 2.7 13.2 2.3 0.5 2.5 0.8 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0.2 0.3 0 0 0 0 0 0 4.1 1.3 2 0 0.4 0 0 0 12.4 0 0 3.1 1.6 3.5 6.1 4.8 15.4 14.1 20.7 13.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	26.3 35.7 36.7 55.7 40.9 73.3 57.1

1769

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1945 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1770

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1946 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1771

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1946 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0.8 0 0.1 0 0 0 0 0 0 0 0.5 0.1 0 0 24.5 0 0 8.3 0 0 3.1 0 0 4.4 0 0 0 0 0 3.9 0 0 0 0 0 0 0 0 0 0 0 1 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 12.1 39.3 0 14.3 12.8 0.9 8.8 0 0 0 0 0 1.4 0 0 1.2 0 0 0.4 0 0. 0.4 0 8.5 2.9 28.4 15.9 1.2 0.5 6 6.5 2.1 2 2.3 0 14.5 3.6 0 6 7 2 0 8.7 0.9 0 3 0 0 0 0 2.7 0 0 0 0 0 0 0 7.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	14.7 91 14.5 29.3 51.4 39.8 30.5

1772

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1946 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1.6 4.3 13.1 5.1 3.5 29.2 7.5 3.8 6 3.5 15.9 9.8 9.3 22.1 25.7 34.7 45.8 28.1 21.9 17.9 14.5 133.5 38.9 181.6 27.3 22.5 68.3 20.6 82 42.4 42 141.2 55.4 182 107.4 78.9 26.6 75.6 20.2 15.7 36.6 21.4 18.3 16.6 51.9 42.3 18.8 46.4 21.6 22.1 9.7 28.9 18.3 6.4 37.4 12 62.9 37.2 55.6 27 17.3 28.9 14.7 36.5 12.6 38.7 33.9 15 53.5 22.5 14.8 4.8 40.4 18.1 8.6 63.7 26.7 44.1 19.4 54.5 22.6 15.3 67.5 24 50.5 30.4 77.2 38.3 21.7 51.6 23.6 61.4 29.5 73 52.5 27.7 88.4 42.3 82.6 50.9 58.2 37.6 25.5 35.9 22.9 52.9 34 17.9 50 30.8 34.6 24.2 27.1 15 36.4 17.1 11.5 30.4 16.1 63.7 25.1 64.1 34.7 18.4 58 24.7 56.6 23.4 12.7 52.9 25.3 61.8 34.8 21.1 27.2 29.7 29.2 32.5 16.3 31.5 24.2 20.7 19.5 21.9 29.8 18.3 29.8 27.9 24 18.8 47.9 53.5 11.9 40.3 72.6 39.3 56.1 46.9 39.7 29.6 38.2 73.5 61 14.1 68 38.2 26.3 36.9 19 16.4 8.2 20.8 13.6 17.2 20 49 56.3 19 20.7 23.7 18.2 31.7 76.7 51 17.4 54.8 34.5 60.1 37.3 28.4 13.7 3.3 19.1 13. 15.1 13 40.8 31.1 9.3 9.3 14.8 18.9 14.1 43.3 59 9.5 20.4 29.7 7.7 13.9						

Total	1396.4 861.2 1176 1042.9 694.3 1241.5 811.3

1773

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1946 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	33.4	17.6	50.6	24.1	15.6	19.6	24.7
12	42.2	68.2	5.8	35.3	50.3	17.2	68
13	18.8	35	11.2	38.8	35.4	16.5	51.8
14	59.6	60.6	15.6	54.9	46.3	21.1	48.7
15	38.5	29	17.7	25.3	18.7	13	25.8
16	14.3	2.5	70.6	2	1.2	32	3.1
17	33.3	30.4	11.9	33.3	22.4	103.2	55.9
18	10	13.6	14.9	8.8	10.6	13.2	19.4
19	26.5	16.6	27.8	19.8	12.8	25	22.3
20	46.2	9.6	71.6	53.7	46.7	63.5	21
21	22.5	8.1	11.9	29.4	22.3	28	14.9
22	25.6	7.5	49	30.8	45.6	51.2	8.6
23	20.2	9	20.1	15.5	9.9	24.3	8.7
24	2.4	189	72.3	8.3	83.5	0.6	1.2
25	4.2	3.2	10	4.5	9.5	8.8	3.6
26							
27							
28							
29							
30							
31							

Total	865.6 838.6 512.2 1105.3 809.8 719.7 1085.1

1774

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1946 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 9.2 9.2 2.8 13.1 1.2 4.3 10.2 7 17.2 12.5 0 15.4 10.1 0 11.7 1.7 1.2 1.4 1.4 4.4 0 0.5 0 0 3.1 0 0.5 0 13.7 5 12.5 0 1 3.7 4 19 0 0 0 0.7 1.4 0.5 4.2 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10.6 2.6 0.7 0.4 14.2 0.4 0 25.1 18.4 0.6 4.1 5.3 2.2 1.9 0 0 0 0 0 0 2.6 0.8 0 0 0.3 0.9 8.7 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 0 3.3 0.2 0 0.2 0 19.4 6.7 8.3 17.2 5.9 6.2 5.7 2.8 0.6 0.3 0.6 0 1.3 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	95.8 58.1 30.8 42.2 50.1 26.2 81.8

1775

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1946 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.8 0 0 0 0 1.1 0.2 0.5 0.3 0 0.9 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0.2 0 0 1 0.3 0 0 0 0 0 1.4 2.7 0 0 2.4 0 1.1 0.8 0.2 6.6 2.1 3.7 0 0.7 0.9 0.1 0 0.1 0 0 0.8 0.1 0						

Total	8.1 2.3 9.7 0.3 1.8 6.2 3.6

1776

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1947 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1777

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1947 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 17.5 2.9 30.3 0 9.1 0 0 2.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0.8 12.5 4.2 0.5 4.7 0 13.7 0 3.4 1.7 0.1 7.2 1 15.1 2.5 7 8.2 3.6 14 5.8 11 2.5 1.6 19.3 4 6.4 1.4 6.4 6.2 2 12.2 5.5 3.1 0.9 0.1 0.3 0.2 4.8 2.1 2.8 0.7 0 0.2 0.2 0.2 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	33.5 19.5 47.2 24.2 39.9 50.2 50.8

1778

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1947 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0
13	11.3	21.2	7.1	100.2	24	3	3.1
14	0.6	8.2	0.1	17.3	0.9	0	4.9
15	122.7	64.7	75.5	170.9	88.4	135.6	98
16	95.2	73.3	56.1	23.7	33.1	65.1	35.3
17	25.6	20.1	80.2	27.9	11.6	22.7	16.6
18	9.3	0.6	0.3	1.2	4.4	1.4	2.3
19	38.7	4.1	1.2	8.2	1.6	29.9	15.6
20	2.9	0.8	2.9	0	0	0.3	1.2
21	67.9	34.8	29.8	36.6	3.3	1.4	5.5
22	5.7	8.2	7.1	8.1	2.1	30.5	15.5
23	35.3	21.2	9.9	2.1	33.8	13.3	4.5
24	15.4	15.7	8.7	38.2	14.9	6.2	31.9
25 26 27 28 29 30							

12	0.6	0	3.4	0	12.8	3.4	62.8
13	6.8	2.7	3.9	2.8	3.4	0.5	6.8
14	68.1	14.8	78.8	29.1	11	44.6	14.8
15	92.8	56.1	36.7	153.1	76.9		
16	48.3	42.5	17.2	9.3	25.7	31.1	2
17	16	16	14.6	5.9	5.8	18.4	9.2
18	1.9	1.1	1.2	1.3	2.9	1.1	0.6
19	6.4	23.3	11.2	28.5	28.4	6.4	2
20	1.6	0.7	2	0	10.3	0.2	0
21	0.8	0.5	1.7	0.4	14.4	4.7	16.9
22	15.5	5.2	27.6	11	14.1	24.9	17.8
23	4.5	11.9	5.3	20.4	9.4	24.4	28.7
24	6.2	31.9	14	79.1	57.8	98.5	47

12	1.1	20	0	38.9	9.5		
13	0.6	0.2	4				
14							
15							
16							
17	5.9	5.8	18.4	9.2	4.2		
18	1.1	4.1	0.3				
19	28.5	28.4	6.4	2	0.8	7.9	
20	0.3	3.8	0.3	31.2	56.3		
21							
22							
23	9.4	24.4	28.7	11.1	29		
24	34	60	24.2				

Total	758.3 405.8 718.6 810.7 407 788 474

1779

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1947 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.5 7.3 8.7 10.1 7.1 11.8 12.2 10 6.4 5.6 31.5 13.5 7.9 13.5 5.2 2. 2.9 26.8 9.1 3.5 10.7 1.3 0.7 0.5 4.8 1.5 3.1 2.3 0.8 0 4.2 0 0 2.3 0 11.5 3.6 0.2 0.9 1.4 0.8 0.5 8.1 2.8 3.5 6.2 8.3 2.6 2.8 5.6 4.2 0.3 8.1 3.4 10.6 5 5.5 1.6 3.3 0.6 0.7 0.9 0.3 14.1 5.1 11.6 12 7.4 3.5 7.1 100.3 53.5 2 16.3 18.8 7.7 6.5 51.6 17.1 25.9 17.7 16.7 6.1 8. 24.8 13.3 2.2 27.3 17.2 12.3 15.3 23.9 16.4 3.5 13 6.2 1.8 7.3 1 0 8.6 3.6 1.3 0.8 2 25 17.7 2.2 28 15.7 1.9 11.4 39.2 9.2 45.5 3.2 11 6.9 0.9 78.6 29.5 120.2 146.1 62.9 63.6 64.1 136.6 66.8 60.1 119. 61.6 148.4 87.8 82.2 48.3 36.5 62.8 33.6 56.2 43.5 75.2 53.4 32.8 55.4 39.2 67.2 53.1 79.4 66.4 86.1 66.9 46.3 48 63.5 93.9 56.9 42.2 83 49.2 109.2 71.5 63.8 37.6 35.1 53.7 30.4 51.8 40.3 39.7 45.6 34.8 43.7 27 23.8 39.6 24.2 24.8 11.4 42.4 29.4 30.8 47 29.4 23.6 21.8 39.5 23.3 17.6 30.6 28.7 26.8 12.7 58.2 32.9 17.2 36.1 66.1 56 12.5 49.5 56.6 32.9 49.7 27.1 33.9 40.3 17.2 21.4 27.9 29.5 52.1 34.3 26.9 69.9 50.1 53 51.9						

Total	1212.4 766 704.1 1118.1 703.3 832.1 814.4

1780

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1947 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	4.2 1.4 1.2 0.9 1.4 2.3 0.8 2 0.6 3.9 0.1 0.2 0.8 0 0 0.7 0.5 3.8 1.9 3.3 2.7 0 0 1.1 0 0 0.3 0 1.7 0.7 0.4 3.1 1.2 0 1.2 2.6 3.4 0 0 0.8 0 0 0.4 0 0 0 1.4 0.2 0 0 0 0 0.6 0 2.2 0 3.3 0 0 9.4 0 2.1 0 0 0 0 0 0 0.5 2.7 0 31.2 10.8 0 11.8 1.7 0.5 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0.1 0 2.6 0.9 0 1.2 0.7 0 1.2 31 20.1 0 12.2 9.1 0 5 0 1.4 3.6 0 0.9 0.8 2.1 28.6 20.2 2.2 12.4 8.7 1.8 21.2 2 1.5 0 20.5 7.1 4.1 8.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	76.9 57.8 13.1 85.4 53 14.9 60.2

1781

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1947 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.2 0 0 0.1 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 1.6 0 0 0.3 0 11.6 0 0 0 0 0 0 8.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 1.6 0.2 0 0.3 0.3 19.9

1782

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1948 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1783

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1948 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0.8
16	0	0	0	0	0	0	0.1
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0.5	0
19	0	6.1	0	0	0	0	0
20	0	0	0.3	0	0	0	0
21	0.2	4	1.2	0	5.1	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.2	2.1	0	0	0	4.5	0.9
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0.3	0	0	10.7	0	0	3.9
19	0	0	0	0	0	0	0
20	0	1	0	0	0.2	0	0.3
21	13.1	0	0	0	0.6	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.2	0.5	0.3	0	0.3	0	0.7
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0.2
19	0	0	0	0	0	0	0
20	4.6	0	0	1.8	0.3	0	1.6
21	0	1.5	0	0.8	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.2	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.5	0	0	1.6	0.5	0	0
21	0	0.2	1.6				

Total	4.6 22.1 4.5 0.3 20.5 5.8 14.2

1784

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1948 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0	0.5 0 0 0
13	0	0	3.3	0	0	0.3	0 6 3.2 5.2 32.9 11.5 4 12.9 1.6 0.2 6.3 0.8 0.2 2.3
14	4.4	5.3	5.3	26.8	1.8	1.8	7.7 0.9 45.1 9.8 13.7 7.4 6.5 2.8 1.4 0 1.8
15	1.2	0	0.3	2.1	0.3	7.1	44 24.5 3.7 11.6 5.9 1 60.4 60.2 35.4 60.4 45
16	36.5	54.7	89.6	37.2	26.4	75.2	73.5 58.3 101.4 17.4 24.6 46.6 42.6
17	30.6	63.1	34.1	86.1	29.5	76.3	72 33.5 55.3 78 70.6 24.3 79.4 55.4
18	32.4	54.1	32.9	22.7	7.2	21.3	6.5 4.2 53.6 13.2 29.2 11.5 55.7 29.6
19	12.7	62.4	24.3	31.2	12.1	48.2	43.6 17.7 44 25 23.4 7.9 25 22.5 8.
20	16.8	16.3	11.5	10	44.3	17.4	8.2 24.1 10.1 42 30.5 33.8 53.5 26.9
21	42.5	28	51.8	46.9	48.6	61.3	35.7 53.4 45.1 129 48.8 44.9 78.4 50
22	80.2	66.7	50.5	46.7	83.6	29.1	23.7 88.2 34.8 122.6 62.8 74 107.8
23	65.5	62.7	80.2	28.4	13.4	9.1	35.4 25.7 63.6 56.1 23.9 9.5 27 25.5
24	11.4	18.1	14.2	24.6	14.4	48.5	18 8.7 14.1 10.2
25 26 27 28 29 30							

Total	980 561.8 909.6 880.8 547.7 916.1 746.2

1785

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1948 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	6.8	6.9	0.3	3.9	2.6	1.1	2.1 1.4 0.4 1.4 1.1 0.4 0.7 0.5 0 2 0 0 0.4 0
13	0.3	0.1	0	0	0	0	0 0 0 0 5 0 0 3 0 0.8 1.4 6 0 0.3 2.8 0 17 22.5 97.3
14	8.6	6.6	29.3	3	65.7	45.5	68.6 96.9 48.5 54.2 53.7 54.8 45 43.3 48
15	38	40.8	71.3	60.7	37.9	50.5	57.5 33.7 32.2 54.8 68.9 46 31.6 152
16	71.8	39.2	75.1	59.9	55	51.7	67.8 48.4 28.5 53.6 66.4 92.5 40.5
17	51.5	66.1	22.1	44.3	98.3	64.3	30 65 57.4 20.9 64.2 57.6 53.6 13.1
18	31	27.6	4.1	22.8	48.7	38.9	6.9 11.8 27.4 5.4 16.9 41.2 32.7 7.8 21
19	24.1	4.5	25.3	38.4	59.6	41.7	40.7 47.1 28.4 37.8 64.7 32.4 7.9 50
20	31.8	6.6	40.4	21.7	11.4	2.6	19.4 12.7 4.8 17.3 8.1 11.5 6.1 9.6 8.1
21	4.9	7.6	10	7.7	1	9.5	7.2 4.5 10.8 9.3 8.1 12.2 6.1 6.8 9.9 11.3 14
22	11.3	27.4	18.1	10.5	10.2	10.9	26.2 19.1 29.4 24.9 14.3 14.8 16 25
23	13.5	14.8	33.5	16.5	8.6	19.7	19.8 8.7 6.5 8.9 6.9 3.8 8.6 10.2 5.1
24	32.2	16.8	6.5	3.2	8.5	11.7	9.1 4.9 9.8 6.4 4 6.7 3.5 5.1 7.1 11.9 6.3
25	5.2	17.9	7.5	5.4	2.9	26.6	11.4 5.7 16.1
26 27 28 29 30 31							

Total	919.1 752.6 650.7 904 645.8 403.4 717.5

1786

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1948 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.2 0 0.4 0 0 0.4 1.3 0.1 0 0.1 0 0 0.8 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 42.3 0 0 8.2 0 0 19.4 6.3 0.2 4.6 11.1 0.5 3.5 7.1 26.2 0 0 6.7 1 0.3 2.9 1.6 0 7.1 3.4 6.2 10.2 0 0.2 0 0 2.1 0 0 10.7 4.9 0 23 15.6 0.3 12.2 0 1.2 0 12.1 4.2 0.1 6.9 26.4 17 0 4.2 5.6 1.7 1.9 0 7.3 0 8.7 1 1.8 0 0.4 0 0 0 0 0 26.7 11.2 0 0.4 3.9 8.4 2.4 0 0 0 0 0 0.1 0 1.5 1.6 0.2 1.6 0.7 0 0.5 0 5.5 0 0.7 1.3 0 0.3 0.6 0 8 0.5 2 4.8 0.2 19.5 6.1 6.3 5.6 3.4 17.2 19.8 2.3 16.4 29.6 73 27 16.8 28.8 31.5 13.5 2 8.3 13.5 13.6 10.3 3.4 1.4 0.1 2.1 1 0 0.7 0 0.1 0 2.8 0.9 0. 1.1 0.3 11 0.2 2.3 2.9 0 0.9 33 10.2 0.9 2.1 4 1 0.4 36.4 11.7 0 5.8 6.3 1.7 2.2 0 0 0 0.5 0.2 0.3 0.7 0 0 0 0.9 0.3 0.2 0.4 0 0.1 0 3.3 1 0 1.3 0 0 0 0.5 0.2 0 0.2						

Total	222 196.2 48 161.4 134.3 76.2 108.4

1787

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1948 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 1 0 0 0 0 0 0 0 0 6.4 0						

Total	0 0 0 0 1 0 6.4

1788

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1949 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1789

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1949 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	2.6	0	0	0.5	0	0
16	14.5	0.5	0	24	0	26	0
17	0	4.1	0	0	0	0.3	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	2.4	0	0	4.6	0	7.1	0
16	0	2.7	6.8	7.7	22.2	0	4.1
17	6.9	2.3	0	2.6	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	4	0	0	0.8	0	0	0
16	1.2	1.8	0	0			
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Total	7.7 46 0.5 11 43 3.9 44.3

1790

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1949 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	3.5	2.2	17.6	16.5	8	13.6	12.7
13	28.6	23.4	10.7	16.2	16.9	11.2	4.7
14	18.3	21.3	17	9.8	12.5	4.4	12.8
15	32.2	17.6	44.5	20.8	13	6.3	13.9
16	2.2	1.8	2.6	0.2	0.5	1.2	3.3
17	0.3	3.1	4.4	1.4	0.2	1.6	1.2
18	0	0.5	18.3	4	1.4	4.1	1.5
19	6.3	2.2	6.7	1.9	14.2	15	4.5
20	3.1	43.9	38.9	12.5	39.6	19.4	5.3
21	16.3	5.9	4.9	6.5	6.1	7.4	78
22	64.1	27	15.8	27.3	56.3	157.4	61.7
23	52.6	52.8	82	1.7	3.5	0.6	15.5
24	5.4	2	1.3	7.6	22.2	8.2	9.4
25							
26							
27							
28							
29							
30							

1 2 3 4 5 6 7 8 9 10 11							
12	1.9	34.9	7.6	2.6	14	9.8	8.7
13	4.7	10.7	63.4	29.7	18.1	57.4	4.1
14	21.9	29.2	18.4	17.2	25.7	6.3	13.8
15	68.7	28.1	70.2	46.4	1.4	2.4	1.1
16	1.6	0.3	1.3	1.2	2.4	4.9	0.8
17	1.4	2.4	2	0.8	3.1	1.4	0.2
18	9.6	1.2	0.5	13.1	2.7	2	0.6
19	39.2	11.3	2	5.4	11.6	4.3	2.2
20	19.4	5.3	3.5	7	40.2	13.3	42.8
21	78	9.2	4.3	25.9	4.4	17.9	36
22	157.4	61.7	134.8	102.6	11.1	8.2	5.8
23	15.5	19.7	15.6	13.2	0	0.6	4.6
24	9.4	9.5	0.7	0.2	9.3	2.5	0.8
25							
26							
27							
28							
29							
30							

1 2 3 4 5 6 7 8 9 10 11							
12	34.9	7.6	2.6	14	9.8	8.7	7.8
13	63.4	29.7	18.1	57.4	4.1	11.	
14	29.2	18.4	17.2	25.7	6.3	13.8	4
15	28.1	70.2	46.4	1.4	2.4	1.1	3
16	4.9	0.8	0.6	1.9	0.3	0	
17	3.1	1.4	0.2	0.4	0	0	0
18	13.1	2.7	2	0.6	13.6	4	1
19	11.6	4.3	2.2	22.5	5.2	6.	
20	13.3	42.8	29.1	2.4	4.5		
21	4.4	17.9	36	40.7	43.8	21.7	
22	102.6	11.1	8.2	5.8	130.4		
23	13.2	0	0.6	4.6	9.6	4.5	1.3
24	2.5	0.8	17.1	3.1			
25							
26							
27							
28							
29							
30							

Total	142.1 172.5 533.7 790.3 353.7 706.1 535

1791

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1949 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	57.6 61 18.5 113.5 65.7 48.3 68.6 15.8 15.4 21.5 53.7 31.1 18.1 35.7 50.8 49.3 12.4 48.7 45.3 21.8 47.7 26.1 32.6 7.4 43.8 27.6 14.7 34.3 26.1 18.8 9.5 22.7 14.9 8.4 18.4 37.2 18.9 6.6 14.1 12.7 17.2 15.3 12.9 13.7 1.9 42 17.6 9.7 21.1 9.4 4.8 6.6 2.6 5.9 5.8 1. 5.2 4.7 12 7.9 8.5 5.9 4.2 9.2 9.6 16.1 41.9 20.3 12.1 22.5 53.6 37.6 7.7 54.5 29.8 24.5 37.1 12.7 11.5 13.4 25.7 13.5 37.2 19.7 5. 18.4 12.3 49.3 26.4 35 41.8 43.6 31.1 6.3 44.7 27.5 18.9 28 4.2 6 3.1 7.2 10.5 4.7 7.8 1.3 4.7 15.2 8.1 9.3 8.3 10.3 13.2 12.2 4.7 30 17.9 18.1 29.5 13.6 6.1 19.2 5.8 5.3 18.6 7.5 9.6 5.6 8.3 13.9 7.8 30.9 13 16.4 12.4 7 19.6 11.1 5.3 9.3 2.6 2.9 4.7 10.2 4.6 7.7 8.6 10.3 4.5 1.5 7.2 4 5.5 3.5 4.2 1.6 2.1 1.3 0.9 1.4 0.5 6.2 1.8 4.8 0. 0.8 8.1 0.8 4.2 1.8 5.1 4.5 1.9 2.9 2.9 4.8 2 1.8 4.7 6.6 2.3 2.1 42 8.6 16.5 31.4 6.6 10.1 9.3 45.7 19.6 14.7 34.3 23.5 14.9 19.3 29.6 16.1 19.5 24.1 18.5 21.6 13.5 32.7 36.6 16.4 40 22.3 15 15 5.8 2. 55.9 2 2.1 48.6 4.3						

Total	612.2 472.4 352.7 810.7 500.5 501.6 553.5

1792

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1949 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.3 0 0.9 0.4 0.1 0.4 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 1.2 0 0.6 3.8 0 15.6 0 0.7 2.5 2.8 1.3 0 3.6 44.4 16 2 4.8 10.4 1.9 7.5 17.7 7 2.3 27.9 11 6.9 12.3 9.6 3.3 0.3 12 4.6 0.2 4.3 0 0.4 0 8.3 2.8 0.9 3.3 0 0 0 0 0 0.3 0 0 0 2.9 0 0 1.5 0 0 0 0.9 0 0.1 0 0.4 1.1 0 6.5 2.3 0.2 2.5 0 0.3 0.2 1.7 6.2 1.4 0.8 0 0.7 0 0 0.1 0 0 0 12.7 0 0 2.5 0 0 6.4 2.2 21.3 0 5.6 6.8 0 4.4 21.1 12.1 13.9 19.7 3.3 16.6 4.1 25.2 4.4 75.3 37.8 6 48.8 0.2 1.1 6.8 17.4 8.2 1 17 51.6 92.7 25.5 58 51.2 16 35.5 34.2 25.8 3.9 22 14.4 17 16.8 7.3 24.7 7.4 30.5 17.3 4.2 11.5 56.7 17.8 15.8 13.8 10.8 10.2 7.1 0 0 0.2 0 0 0 0 4.8 1.6 3.3 5 2.1 2.6 1.9 0 0.2 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	242.1 256.3 112.2 301.4 212.5 80.7 205.5

1793

DAILY RALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1949 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0.4 0 0 0 0 0

1794

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1950 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1795

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1950 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	5.3	0	0	1	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0.7	0	0	0.1
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.6	0	0.7	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	5.1	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	1.1	0.2	0.2	0.3	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	1.4	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.2	0	4.9	4.1	0	1.9	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0.3	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	1.9
20	0.2	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Total	1.1 7.8 0.2 7.1 6.1 0 7.7

1796

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1950 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	3.4	0	11.3	0.2	2.2	7.4	0
13	86.4	55.8	47.1	53.9	142.4	86.7	27.8
14	3	1.1	5.3	1.6	4.4	0.3	8.1
15	3.5	0.3	3	0.6	0	0.2	0
16	6.8	5.5	6.9	2.3	5.1	3.7	1.7
17	2.2	9	26.4	9	22.5	11.9	25.8
18	28.3	11.1	43.5	17.8	48.6	19.9	50
19	28.4	17	45.7	19.5	32.4	15.2	14.9
20	27.1	79.5	33.4	58.5	47.4	14.3	8.3
21	60.9	18.6	9.6	15.7	9.3	111.2	75.7
22	0.8	1.6	0.2	0.3	0.3	0.6	0.2
23	1.4	2.7	1.7	4.8	1.2	0.3	7.6
24	2.7	0.9	20.8	7.3	6.6	9.1	7.1
25							
26							
27							
28							
29							
30							

0	11.3	0.2	2.2	7.4	0	26.3	22	5.4	4.7	16.5	36.3	7.5	83.5	75.8	51
55.8	47.1	53.9	142.4	86.7	27.8	99	70.6	113.4	74.3	1.1	1.1	7.8			
1.1	5.3	1.6	4.4	0.3	8.1	0.4	0.1	1.8	0.3	5.6	2.2	6.8	0.4	0.6	2.7	0.7
0.3	3	0.6	0	0.2	0	9	3	4.7	1.2	1.1	1.5	0.6	22.6	8.2	2.6	13.2	6.5
5.5	6.9	2.3	5.1	3.7	1.7	5.2	9	7.8	14.8	29.5	6.9	7.6	13.5	4.6	11.6		
9	26.4	9	22.5	11.9	25.8	6.6	83.5	10.2	5.5	53	8.8	22.1	6.7	22.3			
11.1	43.5	17.8	48.6	19.9	50	46.7	20.8	65.7	37.5	77	31.1	12.5					
17	45.7	19.5	32.4	15.2	14.9	17.6	10.4	30.3	15.1	56.5	26.8						
79.5	33.4	58.5	47.4	14.3	8.3	10	52.5	26.7	43.8	27.6	38.8	7.8					
18.6	9.6	15.7	9.3	111.2	75.7	6.5	101.5	54.9	45	65.4	1.9	2.6	0				
1.6	0.2	0.3	0.3	0.6	0.2	3.5	1.3	0	1.3	0	0.4	0.9	0	0	0	0	0	0.5	1.2
2.7	1.7	4.8	1.2	0.3	7.6	2.7	3.2	3.5	21.2	7.8	1.9	8.4	4.8	2.7	4	8.5			
0.9	20.8	7.3	6.6	9.1	7.1	3.7	19.5	26.2	9.4	9.8	10.3								

Total	798.6 436.5 484.9 700.7 390.7 690.1 448.5

1797

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1950 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	7.4	4	2.7	10.3	6.1	4.8	7.1
13	35.7	15.2	7.1	14.6	18.6	37.9	3.5
14	53	28.1	11.5	25.5	48.9	39.7	56.4
15	86.3	110.1	85.8	130.5	106	107.8	93.9
16	36.9	31.8	72.3	48.6	37.4	58.5	50.5
17	24.6	2.7	14.3	18.4	10.4	18.7	14.1
18	4.8	2.2	3.2	2.4	1.9	2.7	3.5
19	5.7	4.3	1.2	11.7	5.7	2.4	8.3
20	3.8	2.9	2.2	0.7	0.6	0	1.7
21	2.2	22.4	1.9	5.4	9.3	1	14.9
22	1.8	7.5	4.8	1.8	1.6	0.5	7.6
23	0.5	6	4.3	2.5	18.3	23.4	13.2
24	2.9	0.8	2.9	2.2	0.8	5.4	1.4
25	8.7	21.4	9.6	7.9	11.8		
26							
27							
28							
29							
30							
31							

Total	524.5 542.3 308.5 928.1 606.4 469.7 654

1798

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1950 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	3.3 1.6 0 6 4.1 0.2 2.3 4.5 2.7 0 0 0.7 3.3 1 27.7 8.8 0 0.4 2.8 1.2						
15	12.6 35 12.1 5 20.3 10.3 3.1 14.1 5.2 5.2 0.2 19.8 9.4 7.7 21.7 0						
16	7.4 0 2.1 5.8 5.9 4.7 0 0.9 0 5.2 1.9 0 2 0.2 2.2 0 3.4 1.5 12.8 3.1						
17	15.6 22 2.5 33.2 40.9 17.4 55.9 6.3 9.4 4.8 9 21.1 25.2 14.9 14.2						
18	30 1.9 35.2 45.1 13.9 35.1 20.5 11.2 10.1 29.3 31.7 2.4 19.2 4.3 1						
19	2.3 1.2 7.8 1.1 11.7 0 2 3.8 8.4 18.5 17.4 32.8 0.4 10.7 0 3.6 5 1.3						
20	2.3 6.1 2.4 11.1 5.2 10.6 8 3.6 7.8 7.6 1 9.2 11.5 0 3 0 0.4 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	151.1 137.9 42.7 191.5 228.7 120.9 240

1799

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1950 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1800

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1801

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0.5	4.1	5.8
18	2.8	0	0	0	0	0	0
19	0.6	0	0.5	0.4	2.2	17.9	50.9
20	0	0	0	0	0.8	0	0.2
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	3.5 7.1 25.5 59.6 26.9 6.7 25.3

1802

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	29.4	10	58.8	49.3	17.4	17.2	18.8
12	0.1	1.7	2.8	0.9	0.2	1.1	27.2
13	1.3	0	7.7	0.9	8.5	2.9	3.3
14	8.1	7.2	8.1	2.5	17.8	25.9	8.9
15	113.8	63.2	97.2	17.9	33.8	48.8	22.9
16	48.3	202	98.5	26.5	33.7	44.9	62.5
17	14.1	18.4	47.2	20.7	32.8	47.2	25.5
18	44.3	48.7	70.9	63.1	39.8	3.3	25.5
19	24.4	23.6	25.4	50.1	28.7	10	20
20	33.4	34.8	38.8	149.4	68.8	49.8	55.5
21	40.1	20.5	27.4	23.5	15.5	7.8	31.1
22	12.1	71.1	35.1	13.4	41	45.1	42
23	69.2	35.5	15.6	58.1	11.8	26.5	2.4
24	41.3	85.7	46.3	24	44.1	37.6	26.5
25	1.7	13.8	13.4	7	13.4	4.7	4.3
26							
27							
28							
29							
30							

Total	1429.3 799.6 819.5 960 660.2 636.8 773.9

1803

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	68.9 48.9 9.8 25.1 30.2 19.4 30.3 11.8 16.5 2.7 14.7 11.1 5.5 20 5 5.4 3.8 15.8 7.5 7.7 15 24.6 14.1 5.8 53.9 22.7 6.9 28.6 32.4 29.3 4.7 27.2 20.7 10.8 23.5 10.4 19.8 8.7 14.9 20.2 17.1 21.6 9.5 20.6 17.5 44.5 25.9 15.6 36.9 49.7 61.2 10.2 31.1 36.7 19.5 39 26.2 48.1 18.8 55.1 55 16.6 57.3 40 31.1 11.1 19.4 33.6 9.6 42.3 33.7 24.8 6.5 16.4 14.1 10.9 19.2 7.4 9.8 7.4 12.4 10.6 9.1 13.5 7.9 7.6 1.8 15.7 8.7 4.9 9.1 7.5 5.5 1.7 11.7 5.1 3.5 12.7 4.5 2.8 4.4 24.3 8.9 8.2 12.7 19.2 9.7 7.2 22.1 10.6 9.2 11.7 19.9 20.2 24.6 69.9 30.8 19 34.8 44.6 23.9 10.6 63.8 33.7 30.9 34.4 14 9.3 11.3 21.3 23.7 67.1 25.3 32.3 18.1 10.4 10.4 9.1 11.2 8.7 11.4 6 11.5 22.7 10.1 11.4 13.7 10.2 7.4 14.7 37.5 14.1 5.7 18.9 21.9 16.5 3.2 10.4 9.4 7.9 7.4 8.1 14.4 2.3 7.2 13.2 6.4 13.5 3.3 1.5 0 0.2 0.9 1.3 4.9 0.2 4 0 0 1 0.2 6.5 0 0.4 0.7 0.7 0.3 0.4 0.3 1.2 5.7 0.3 2.2 1.7 19. 4.1 11.6 3.4 0.7 1.4 0.8 0.2 0 0 0.1 0.4 2.8 0.9 0 1.1 0 0 1.2 0.7 0. 6.9 2						

Total	537.9 486.1 214 655.5 471.6 362.4 569

1804

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	76.5 51.6 32.2 27 45.2 80.1 30 17.6 9.5 60.5 62.3 24.4 73 47.6 46.5 21.7 14 11.3 16.6 15 17.3 3.3 6.8 3.4 16.1 8.7 8.4 10.3 4.2 4. 0.2 28 26.6 9.6 12.2 0.3 6.4 0 0 1.7 0.2 0 7.1 2.2 0 0.1 0.7 0.1 0 15.3 7 0.8 7.3 3.5 6.4 4 24.6 9.3 16 5.2 5.3 10.9 17.5 17.1 11.2 2. 26.6 17.3 26.8 40.4 3.6 16.5 0.6 0.9 19 0 0 0 0 0 0 2.3 0 0 0 0 0.9 0 0 4.5 0.4 1.6 0 36.6 12.3 0 13.8 1.9 0.6 0.3 1 0.5 0 0.4 0 0.1 2 2 4.7 4.6 2 1.9 0.3 0.3 0.5 0 2.6 2.4 0 0.2 1.7 3.5 1.2 0 1.3 0.3 0 0.2 0 0.5 0.1 1.2 0.2 20.7 3.9 1.3 8.1 4.7 14 10.6 2.4 1.5 2.8 5.2 5.3 0 0 0 0.8 0 0 0 0 0 0 0 0 0 1.5 0 15.6 0.2 0 1.3 0 8.3 6.1 1.5 2.4 0.9 5.7 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 0 9.5 0.2 0 0 0 0 1.4 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	247.7 171.5 184.9 237.4 196.1 258.5 215.5

1805

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1951 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1806

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1952 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0 0 0 0 0 0

1807

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1952 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 0 0 0.4 0 0 0 0 3.3 0 0 8 0.9 2.2 0.7 1.2 0 0.2 0 7.7 0 0 0 0 0 3.8 0 0 0 0 11.5 1 7.8 4.5 3. 0.2 0 3.6 0.4 0 1.9 0.6 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.4 0 13 0 3.2 0 0 0 0 0 0 0 0 3.8 0.2 0 0.7 0.1 0 0 0.7 0 0 0.1 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 5.1 0 0 1 0 0 0 0 0 0 1.3 0 12.8						

Total	8.9 21.8 4.9 0 32 9.5 36.2

1808

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1952 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	11.8	6.6	0.5	23.5	9.3	4.2	9.3 5.9 1.3 23.1 4 1.5 25.3 6 34.5 10.6
12	27.1	37.5	14.7	53.5	23.9	11	2.6 20.9 7 6.4 40 10.4 83.5 41.8 16.6
13	50.7	27.1	9.2	20	44.5	21.8	14.7 32.5 15.8 28 22.4 5.6 9.5 10.4 19
14	9.5	20	19.8	2.9	11.9	39.8	0.5 2.9 15.7 4.8 69.1 33.4 57.6 20 15.1
15	73.4	21	41	12.8	48	6.6	7.6 33.2 10.1 13.1 3.9 37 24.5 8.4 56.9 25
16	4.8	2.3	27	5.8	2.4	17.8	7.9 19.2 6.2 20.9 27.4 9.5 30.6 18 28.5 8.3
17	33.5	20	8.7	62.2	20.2	81.6	31.5 53.2 76.2 33.5 53.1 40.4 19.6 6.8
18	22.4	13.1	8	35.2	18.3	14.8	9 20.4 10.2 6 16.1 16.1 10.9 5.4 37.2
19	11.2	5.9	21.5	8.4	62.8	21.6	42 22 12.7 26.6 11.2 64.4 18.8 39.7
20	16.6	15.6	34.5	15.6	15.2	8.1	36.8 29.6 14.7 56.3 26 44.6 24.3 42.
21	42.6	28.4	56	39.8	80.8	51.1	42.8 60.4 50.5 71.4 44.8 46.6 35.7
22	12.6	69.1	45.2	54.1	58.4	15.9	23.8 2.9 4.1 14.7 16.9 39.2 37.9 51
23	9.4	44	43.8	28.5	40.8	21	12.1 5 12.7 8.3 10.6 18.2 25.2 26.9 13.1
24	34.1	18.2	39.7	27.2	25.2	39.6	27.9 49.6 34 33.8 43.4 77.5 47.5 9.
25	32.2	31.2	39.5	23.6			
26							
27							
28							
29							
30							

Total	1019.4 587.1 794.6 806.8 509.6 1063.8 690.2

1809

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1952 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	19 39.6 8.9 11.2 25.9 24.3 28.8 31 20.3 8.4 44 35.2 23.8 43.9 40.5						
12	35.2 21.9 50.8 28.6 28.7 36 43.4 42.4 16.9 52 39.1 33.7 42.9 48.6						
13	40.7 9.4 36.1 33.7 20 40.1 22.5 28.7 6 21.4 23.8 34.1 31.5 22.3						
14	29.9 8.2 37.5 54.6 40 73.6 25.2 20.3 1.8 14.4 13.2 15.5 23.7 5.4						
15	22.3 4.1 14.4 10 16.8 13.7 8.9 5.9 4.4 5.8 5.2 16.6 15.9 21.4 17.5						
16	7.5 25.4 16.1 13.7 17.6 16.5 11.8 4.9 28.5 16.3 10.7 21.1 4.9 6.9						
17	6.8 27.9 17 24.7 26.1 34.2 24.4 13.4 35.1 25.1 20.6 37.7 30.6 13						
18	20 45.1 20.3 20.4 28.7 23.3 15.3 8.1 23.4 12.7 17.5 18.8 12.7 7.9						
19	4.3 17.9 9.4 13.4 13.8 10.1 8.4 13.4 14.9 9.3 7.3 12.3 16.5 19.9 5						
20	18.8 16 14.1 18.9 16.1 29.9 12.2 373.6 138.6 29.9 158.6 27.2 26.						
21	32.3 38.5 25 43.9 45.1 99.6 76.4 60.2 138.6 67.8 90.5 84.3 69.8						
22	38.8 21.9 43.6 30.5 29.1 52.9 8.4 23 3 33.6 19.8 27.3 26.6 12.6						
23	12.5 11.7 14.6 12 16.8 14.7 21.4 14.1 7.6 31.2 15.4 12.7 16.3 4.4						
24	2.6 3.6 10.8 5.3 9.3 6.8 3.7 1.8 13.1 2.6 1.8 7.8 3.5 16.1 5.4 6.7 6						
25	3.4 16.6 5.7 8.1 8.8 2.7 6.5 5.1 13.9 7.3 3.7 2.3 1.2 6.3 21.2 7.8 5						
26							
27							
28							
29							
30							
31							

Total	728.1 652.1 349.9 1231.4 757.4 701.5 972.8

1810

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1952 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.4 1.8 1 0 1.3 2.3 1.4 0.7 5.3 0.5 3.5 27.1 18.7 17.5 27.9 17.9 0.5 1.6 10.8 0 3.5 3.1 12.1 0.5 1.5 3.8 0.3 4 11.4 2.3 16.3 7.1 4.1 2.5 32.2 32.1 10.6 10 39.1 26.1 36.6 20 14.9 5.3 26.8 6.7 3 16.2 4 45 33.3 109.5 55 54.6 22.4 36 8.1 11 57.2 32.8 20.8 221.7 58.3 9.7 13.3 24.2 10.5 6 12.1 12.5 1.6 3.4 8.9 17.5 7.1 18.2 10.9 3.1 1 0 0 0.3 0 1.3 0.2 1.3 0 3.9 2 0 1.4 0 0 0 0 0 0 0 0 0 0 0 0 1 15.9 6.1 (4 3.1 0 1.4 0.4 0 0.5 0 0 0 0 16.7 5.5 2.7 9.9 5.1 3.9 4.2 1.5 1.6 2.(10.6 4.1 6.6 5.7 0 1.5 1.3 1.4 0.7 0.7 0.5 0.2 0 3.2 0 0 3.3 0.6 0 3. 5.9 6.9 21.9 3.7 9 0 1.1 0 1.2 0.6 0 1 0 2.4 0 0 0.5 0 0 0 0 0 0 1.8 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	193.1 140.7 271.6 213.2 204.8 369.2 226.4

1811

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1952 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 3.5 0 0.2 3.4 1 12.2 19.8 0.3 0.6 4.8 0.2 2.3 0.6 0 0 0 0.2 0.2 0 0.7 0.2 0 0 0 1.4 0.2 0. 0						

Total	14 20.4 3.8 0.6 8.8 5.2 3.5

1812

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1953 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1813

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1953 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.5 0 1.4 0.1 2 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0.2 0 0.7 19.3 15.1 5.1 0 12.3 2.9 15 7.4 0.9 6.2 5.9 1.5 1.2 25.1 0 0 4.9 0 2.3 0 0.4 0 0 0 9.6 0 2 0 0 7.4 0 3.8 0 0 0 0 0 0 2.6 0 2.1 0 0 0.4 0 0.7 29.7 8. 2.7 5.1 5.9 1.3 3.9 0 0.7 0 0 1.5 0 0 0 0.4 0 0 11.7 0 0 0 6.9 0.9 0 5.5 0 0 0 5.4 0 0 10.7 0 7.6 0 2.4 0 0 3.6 7.3 13.7 0 2.1 0 0 0.4 0 0 0 6.4 0 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.9 0 0 1 0 0 0 8.9 0 8.4 12 0 5.1 7.1 1.3 1.2 2.1 5.6 0 1.5 0 0 0 0 0 0 7.6 0 0 0 0 0 0 0 0.6 0 0 0.1 0 0 0 0 0 0 0 0							

Total	41.4 94 32.9 31.7 85.2 15.2 72.4

1814

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1953 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.3 1 0 0.3 0.1 2.6 4.1 6 3 0 22 13.9 26.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0.2 0 0 0 0 0 0.2 0 0 5.8 0.8 0 0 0.2 0 0 0 0 0.3 0 0.3 0 0 0 0 0.9 2.6 0 13.5 5 0.2 5.1 5.9 1.7 15.6 11.2 3.8 7.6 6.1 16.5 6.3 47.3 22.5 8.7 27.1 11.8 41.8 17.8 58.2 23.1 10.7 34.3 11.9 61 20.8 54 53.4 17.8 53.9 30.5 65.9 19.7 55.6 70.5 22.5 30.8 38.7 40.3 43.5 112.1 196. 85.4 88.8 112.9 135 96.6 130.1 27.1 49.9 93.7 64.8 150.3 136.6 93.7 260.8 160 209 204.4 151.1 192.7 88.5 57.4 104.4 105.3 121 39.2 30.9 23 53.8 56.9 108.1 106.9 47.3 21 14 27.6 25.8 15.7 40. 10.5 10.6 26.1 60.9 27.1 24.5 35.1 31.2 16.3 16.4 9 12 62.1 29.8 4.1 4.7 0 2.2 6.8 2.7 12.8 5.6 4.7 0.9 6.7 9.1 1 6.7 8.3 26.1 50.6 215.1 89.1 37.6 108.7 126.2 120.4 86.3 131.9 132.3 153.9 190.9						

Total	945.8 780.5 877.5 1243.4 849.6 1076.1 1169.1

1815

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1953 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	88.8	62.4	68.2	63.8	67.1	92.7	59.8
12	61.1	123.1	68.4	5.7	16.4	32	12.8
13	31.3	18.7	51.6	12.3	35	47	19.9
14	31.9	11.8	6.5	4.2	22.9	14.4	9.6
15	21.4	24.4	28.4	15.8	79.5	39.1	9
16	41	27.8	28.5	14.4	54	38.4	11.8
17	50.5	41.6	65.9	20.2	18.6	29	11.2
18	58.6	31.9	67	31.4	98.7	59.7	74.4
19	68.3	62	17.4	44.4	11.3	12.9	32.5
20	29.8	14.9	12.4	9.8	22.5	16.7	13.5
21	15.3	8	11.6	5.9	5.4	16.1	8.9
22	0.8	13.2	7.2	3.1	7.9	9.1	6.2
23	40.3	18.6	6	2.1	1	2.5	1.7
24	11.3	33.3	12	10.4	14	6.2	4
25	0	1.4	1.3	0.3	0	1.3	1.9
26							
27							
28							
29							
30							
31							

Total	738.3 858.5 365.6 923.2 813.7 619.2 884.8

1816

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1953 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	15.3	27.2	9.2	49.5	39.8	2.4	36.6
13	6.9	0.5	0	1.3	0.5	0.2	0.2
14	10.6	9.8	16.2	43.5	32	14	4.2
15	12.8	6.4	2.1	2.1	1.4	0	9.2
16	0.5	0.9	1.1	0.2	2.2	7.8	10.4
17	0.3	0.4	0.7	1	4.1	0	9.1
18	1.4	2.2	0	0.5	3.5	2	25.3
19	18.1	13.7	5	2.5	6	8.9	3.4
20	31.6	11	1.4	11.9	14.3	34.4	9
21	8.6	12.9	15.9	15.7	18.2	34.6	16.4
22	4.4	41.5	20.7	1.5	12	19.1	9.3
23	24.4	9.5	2.3	4.5	12	32.8	33.3
24	22.2	43.7	33.5	54.1	56.5	37.4	16.8
25	0	1.1	0.4	2.9			
26 27 28 29 30 31							

Total	418.1 375.2 242.3 379.6 340.6 362.7 372

1817

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1953: Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1818

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1954 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1819

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1954 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	16.9	8.5	2.3	0	1.4	0.3	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	25.5 59.6 23.9 0.6 27.2 9.4 8.1

1820

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1954 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	3.1 1.3 0.6 10.2 3.7 0 3.8 0 0 1.4 1.9 0.6 0 0.7 13.4 4.1 1 7.8 3.6 5.1 4.1 1.5 5 175 108 36.4 27.1 44.2 129.7 89.5 101.9 73.5 47.7 130.6 43.8 66 40.7 74.3 12.7 18.2 56.6 11.6 19 20.9 24.9 45.7 23 74 27.7 52.2 31.8 21.4 17.7 21.1 38.7 32 28 14.7 15.8 29.1 15.9 4 43.6 23.1 12.6 6.8 25.3 15.6 23.7 38.4 10.2 7.5 1.7 25.6 18.2 8.6 18.8 13.2 12.9 15.4 18.3 14.1 18.4 11.5 11.4 6.8 17 56.6 20.8 26.1 27.8 51 22.1 36.3 120.6 49.6 67.6 70.2 86.8 67.9 11.6 17.5 38.8 28.6 29.3 17.8 17.7 2.2 1.9 6.2 23.4 4.8 18.8 6.3 0.2 4.3 3.1 5.6 2 18 5.6 0 2.4 2.3 9.1 3 6.4 3.3 0.9 17.8 6.7 12 8.5 7.8 6.2 7.7 9.4 8 24.4 10.3 12.1 5.3 26.5 18.8 7.7 118.5 25.6 12.6 15.5 25.9 45 19.3 23 23.4 52.7 23.6 18.7 28.4 16.9 20.8 17.8 35.3 21.4 7.5 86.2 33.2 17.1 46 8.7 7 25.2 0.6 2.2 26 3.4 58.6 18.8 61 17.7 9.6 54.6 17.3 57.4 20.8 42.4 30.4 15 62.4 19.3 11.9 4.3 15.7 12.7 5.1 31 9.1 8.1 2.8 22.3 17 6.6 42.9 13.1 24.1 10.9 45.7 61.9 23.1 19.4 28.1						

Total	858.9 507.3 807 925 493.1 1041.3 639.5

1821

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1954 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	49.6 17.4 75 70.1 28.3 119.7 52.6 110.1 44.1 42.1 105 44.7 157.8 85.7 50.4 44.8 66.9 80.5 66.2 65.1 84.7 59.9 40.5 33.4 37.8 40.7 39.1 52.5 23.1 20.3 83.5 125.9 70.5 41.5 78.7 159.3 103.8 90.4 111.2 91.9 97.2 96.7 69 68.6 28.1 62.4 47.8 40.2 56.8 27.9 39.8 23.2 49.8 40.9 48.2 64.9 26.7 30.8 7.9 20 31.8 30.2 42.6 25.2 14.(19.8 17.9 12.5 16.3 13.4 11.2 8.8 8.3 26.8 12.7 13.2 16 20.3 15.1 19.7 51.1 23.8 16.2 26.3 32.1 16.3 10.5 24 17.6 18.4 15.3 13.1 9.3 9.4 32.4 16.7 14 18.5 9.9 10.4 7.6 32.4 22 9.8 18.5 19.1 30 6.7 34 31.2 12.9 29.4 15.2 24.5 3.8 7.2 17 24.6 10.7 6.5 13.6 1.7 4.4 4.2 7.5 6.1 0.7 1.2 10.3 9.3 5.1 117.7 21.9 6.8 5.6 8.3 14 5.3 5 5.8 6 2 4.5 4.5 4 2.6 2.1 6.1 2.1 3.3 4.8 1.9 4 2.4 7.6 3 2.5 7 3.4 2.5 4 1.7 3.2 0.7 0.2 1 2.2 1.6 0.7 0.5 4.5 8.4 2.8 8.5 4.4 4.5 2.4 4.1 0.5 1.5 2.3 1 0 0 0 1.9 0.6 0.4 0.8 0.4 0.1 1.5 3.4 1.1 5.6 2.1 1.8 3.1 0.4 0 0.8 15.6 3.8 1.6 4.3 0.6 9.3 5.6 8.7 5.9 39.5 18.1 1.1 8.7 7.7 15.2 6.1						

Total	806 599.1 579.8 964.9 661.3 962.2 831.3

1822

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1954 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0.2 0.4 1.6 8.4 2.9 0 3.2 6.7 4.3 2.9 8						
15	3.1 0.5 3.2 43.3 39.1 1 19.1 22.6 0 6.4 0.9 9.1 0.4 5.8 11.3 1.3 6						
16	21.7 18.1 0.7 1.5 4.1 0 8.3 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0.1 0.2 0.9 0.3 0 0.4 0 0 0.3 0 0 0						
18	0 0 0 0 0 2.1 0 0 0.3 0 0.6 0 0 0 0 12 9.5 5.2 0.3 21 2.2 1.2 13.5 7						
19	4.3 0.9 2.2 0.8 1.7 14.1 5.6 6.3 1 5.9 5.5 4.9 2 24 11.7 22.3 24.3 7						
20	12.2 18.3 18.5 9.5 48.3 19.4 9.2 34.3 6.6 1.9 1.3 9.2 2.7 0 2.8 2 5						
21	0.4 0 3 0.3 0.4 6.7 4 1.6 64.2 21.5 1.1 23.8 1.5 1.8 2.7 32.6 12 3.2						
22	14 0.5 1.8 0.3 0 0.3 0.1 0 0 0 0 0 0 1.8 0.5 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	150.6 150.8 51 223.2 158.7 34.2 123.3

1823

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1954 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 0 0 0 0.9 0 0 0.2 0 0 0 7.9 0 0 3.6 0 0 0 0.3 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 9.7 0 1.2 4 0

1824

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1955 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1825

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1955 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.6 0 0 0 0 0 0 0 0 0 7.8 0 0 1.5						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 15.7 0 0 0 0 19.3 28.3 5.9 20.2 16.5 3.1 18.6 0.9 0 0.3 0 0 0 0 0						
20	0.3 0 0 0.3 0 0 0.6 0 0 0.1 5.3 0 0 0 0 0 1.3 0 0 0 2 0 37 20.7 0 20						
21	0 0 0 0 0 0 0 0 0.7 0 0 0.1 0 0.2 0 0 0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	20.2 39.4 22.2 57.2 44.8 8.7 39.6

1826

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1955 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	5.1	0.9	2	0.4	0.9	14.3	1.7
12	15.9	6.2	6	3.1	3.5	8.6	3.5
13	0.6	0	0.2	9.2	1	0	0
14	149.3	42.8	53.7	64.5	30.5	29.7	22.8
15	22.3	19.1	17.8	80.1	26.1	13.8	30.6
16	14.3	69	30.3	18.4	61.8	26.3	20.8
17	6.5	8	17	26.6	10.2	27.3	17.3
18	28.8	9.2	33.8	8.2	4.1	132.6	18.5
19	20	8.5	50.5	14.9	7.5	47.4	12.6
20	16.9	43.6	28.3	15.3	35.6	16.5	40.1
21	49.5	19.4	96.6	90.5	36.2	85	39.5
22	29.4	11.3	35.1	13.9	7.7	21.6	11.3
23	13.2	27.2	34.5	32.7	103	45.8	31.6
24	25.7	45.6	36.8	62	26.7	29.5	95.6
25	85.6						
26							
27							
28							
29							
30							

Total	959.8 507.5 989.8 788 550.7 980 632.5

1827

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1955 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	64.9	19.7	62.9	49.3	20.6	44.1	21.6
12	24.5	47.9	35.8	36.3	54.8	27.5	57.6
13	37.7	26.3	11.6	48.7	28.5	31.9	28.3
14	61.2	35.2	17.9	33.6	19.4	25.1	23.1
15	18.7	12.7	12.7	21.3	12.7	3.8	13.5
16	32.4	29.5	18.4	11	75.8	30.5	35.6
17	13.4	112	52.1	34.8	52	31.8	48.5
18	21	4.3	2.6	6.2	20.3	7.3	8
19	2.3	1.8	0.2	1.7	14.7	6.8	27.2
20	31	66.1	41.3	63.5	31.8	48.5	58.8
21	16.9	38.4	23.7	36.9	17.5	24.5	24.1
22	26.1	13.3	50.7	21	18.8	22.1	46.9
23	58.6	38.8	66	38.5	39.9	54	23.5
24	79.8	52.8	52	55.4	3.9	40.8	6.7
25	24.3	12.9	22.8	14.2	10.7	40.4	24
26	18	21.3					
27							
28							
29							
30							
31							

Total	1060.3 749.3 722.9 1146.1 649.9 943.5 745.8

1828

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1955 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	53.4 36.3 60.1 52 33.2 66.4 59 70.5 36.2 70.9 66.3 41.6 48.3 51.7 54.9 28.8 37.5 47.9 34.4 57.7 55.5 23.4 24 23.5 87.5 73.1 44.4 68.8 7 6.6 10.4 85 35.6 19.3 37.2 0.4 3.9 0.1 39.8 14.1 5.3 16.9 0 1.6 0.6 29.2 9.9 2.1 14.5 0.3 24.8 0.6 6.7 7.1 1.7 8.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.5 0 0 0 0 14.5 4.4 4.6 0.5 2.3 3.7 1.4 12 3.8 0 0.2 1.2 3.3 0 4.2 1.6 0.5 0.9 0.2 0 0 9.3 3.9 1.9 2.9 2.1 0.6 1.3 10.3 6.9 5.5 22.8 34.5 1.8 17.3 6.7 2.2 2.6 6.4 3.7 9 2.8 24.4 14.9 15.3 7.7 17.2 13.5 4.6 30.4 8 25.2 9 5.8 27.9 10.5 4.3 8 9.8 26.2 16.9 16.3 33.4 0 25.6 1.5 25.9 30.5 7.9 12.4 4.2 3.1 2.4 18.7 8 8.1 8.5 23.3 18.8 3.7 34.4 19.3 10.1 19.1 0.9 0.4 5.9 0 0 14.9 1.6 41.1 17 4.1 38.6 17 20.7 20.1 0 0.3 8.3 6.6 2.2 7.4 3 55.7 17.8 0.3 1.3 5.6 8.8 4.3 40.5 23.1 0.2 14.8 10.6 2.3 8.1 0.9 6.7 0.1 81.6 28.2 9.7 32.8 0 0 0 0 0 0 0 0.6 0 5.3 0 0 0 0						

Total	493.7 328.9 303.4 712.9 454.3 411.2 494

1829

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1955 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1830

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1956 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	4.4	0
16	0	0	1.7	10.4	2	0.4	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21 22 23 24 25 26 27 28 29							

Total	1.7 10.6 2 0.2 6 0.4 5.9

1831

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1956 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0.4	0	0	0
16	0	0.6	0	0	0.5	0	0.2
17	0	4.6	0	0	2.3	0	0
18	0	4	0	0	0	0	0
19	0	3.4	0	0	0	0	0
20	0	0	0	0	0	0	0
21	6.5	0	0	0	0	26.9	28.7
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	1.8	0	0	0.3	0	5.5	0
16	0	0	0	0	0	0	0
17	1.4	0.4	0	0	0.1	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	18.3	10.1	17.2	8.9	6.2		

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	1.1	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0.2	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0.7
21							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							

Total	29.5 35.5 25 10.2 28.3 8.9 13

1832

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1956 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	38.3	17.4	11.6	17.6	11.1	25.1	11.1
12	21.5	7.4	13.4	20.9	13.3	16.4	9.8
13	8.5	8.3	10.6	20.3	11.8	13.7	9.8
14	4.9	7.9	4.9	4	4.8	9	26.5
15	2.9	7.4	3.4	8.6	3	3.8	14
16	0.1	1.1	12.6	1.1	2	1	2
17	15.3	3.7	11.7	1.2	1	9.7	1.6
18	89.7	1.3	3	17.7	3.9	71.9	19.3
19	11.4	9.4	51.2	7.8	33.7	16.5	21.3
20	24.9	11.8	34.6	12.7	9.3	16.9	9.8
21	2.3	3.9	1.9	75.8	28.7	63.8	56.4
22	34.5	79.4	42	63.3	62.3	117.4	212.8
23	40.8	175.1	105.7	74.8	120.8	49.4	72.4
24	132.5	91.2	66.5	135.4	33.6	114.2	238.7
25	109.9	78.5					
26							
27							
28							
29							
30							

Total	1124.6 768.9 1113.8 1063.7 718.2 1028.2 741.1

1833

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1956 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12	49.7	42	32.1	65	39.3	66.7	52.7
13	11.8	34.6	18.7	46.6	48	27.3	51.9
14	117.4	10.4	56.5	23.9	52.8	64.3	45.1
15	35.5	3.7	5.9	1.7	21.2	16.7	4
16	11.3	3.4	12.5	8.4	2.8	9.3	2.6
17	5.8	3	6.5	14.3	11.3	1.9	14.7
18	16.1	20	41.4	51.7	30.8	20.8	32.3
19	58.6	35.4	24.2	13.2	41.3	22.9	10.5
20	54.5	36.6	27	19.2	17.2	36	18.4
21	26.9	12.2	7.9	10.5	17	8.5	12.5
22	4.4	4.4	0.9	9.5	6.7	6.5	7.5
23	5.2	1.9	1.2	0.5	0.3	1.1	1
24	1.1	0.1	7.3	2.7	2.7	2.9	0.5
25	5.2	9.9	5.2	0.9	0.5	0.4	6.3
26							
27							
28							
29							
30							
31							

Total	491.3 528.8 347.8 902.8 595 562.4 743.2

1834

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1956 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	54.1	27.6	2.8	21	18.1	6.7	8.8
14	36.4	13.8	1.7	20.4	14.4	45.4	10.8
15	38.1	18.5	12.7	17.5	36.5	17	9.9
16	4.6	6.2	6.3	1.9	3.3	2.1	2.5
17	0.4	0	0	0	1.6	0.6	0
18	1.1	0.1	0.3	2	1	3.8	8.9
19	14.2	3.8	80.5	76.6	3.5	48.3	1.4
20	2.4	2.1	0.8	1.9	1.1	1.1	0.7
21	0	0	0	0	0	0	16.4
22	7.6	22.4	11.9	5.1	14.7	7.6	5
23	0.2	0	0.3	2.4	3.9	36.9	18.6
24	0	0	0				
25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	1.5	0	1.9	10.4	1.9	17.2	3.3
14	16.6	55.9	4.8	27.8	30.3	24.2	36
15	9.9	56.5	23.6	32.5	28.2	6.6	2.5
16	2.2	8.8	3	0.7	1.7	0.4	1.4
17	0	7.9	0.8	0	0	0.7	0
18	2.1	3.9	4.6	1.5	15.5	25.8	14
19	0.5	16.3	1.9	1	0	0.9	0
20	0.7	14.7	4.6	0	0.2	1.5	0
21	0	0	0	0	0	0	3.2
22	5	7.2	5.7	2.5	5.5	9.5	5.8
23	2.9	10.2	0.2	0.7	0	0	0
24							
25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	1.9	17.2	3.3	2.9	8		
14	4.8	27.8	30.3	24.2	36		
15	23.6	32.5	28.2	6.6	2.5	3.8	11
16	3	0.7	1.7	0.4	1.4	2.8	14.5
17	0.8	0	0	0.7	0	0	2.5
18	3.9	4.6	1.5	15.5	25.8	14	32.3
19	1.4	0.5	16.3	1.9	1	0	0.9
20	14.7	4.6	0	0.2	1.5	0	0
21	0	0	0	0	0.4	0	0.3
22	5	7.2	5.7	2.5	5.5	9.5	5.8
23	2.9	10.2	0.2	0.7	0	0	0
24							
25 26 27 28 29 30 31							

Total	244 213.3 122.2 325.4 297.4 147.8 249.3

1835

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1956 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1836

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1957 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1837

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1957 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	1.3	0	0
17	1.4	1	0	0	0.2	0	0
18	0.7	0	0	0	0	0	0
19	0	2.8	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	3.3	0	0	0.6
22 23 24 25 26 27 28 29 30							

Total	12.3 17.8 0.3 0.3 11.7 0.4 15.8

1838

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1957 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	1.1	0	0	4.3	0.4
13	6.5	2.7	0.3	37.9	20.6	16.4	4.7
14	0	0.3	1.1	0	0	0	0.2
15	3.6	1.2	7.3	1.7	0.8	0	5.5
16	0.6	34.6	3.9	1.4	14.6	3.2	15.8
17	1.2	3.6	19.5	1.3	5.1	5.2	1.2
18	3	0.2	0	1.2	0	5.8	1.6
19	19.5	11.4	41	37.9	12.8	48.6	19.4
20	15.4	4.9	59.7	15.7	7.2	61.2	36.8
21	54.8	52	124.6	74.7	119.3	70.6	49.8
22	41.4	27.4	16.6	26.2	17.4	26.7	24
23	38.5	22.3	31.9	45.7	112.1	66.3	66.9
24	86.7	100.7	92.9	59.6	15.4	114.4	82.1
25							
26							
27							
28							
29							
30							

Total	616.1 391.7 646.1 777.7 495.4 830.8 605.8

1839

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1957 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	28.2	12.6	44.6	38.8	16.4	27.8	28.4 41.9 23.9 25.1 35.2 19.2 45.1
12	24.8	21.5	8.9	9.1	23.7	11.8	16.1 12.5 13.4 3.7 19.1 6.5 5.2 11.9 4.
13	28.5	18.3	7.6	30.5	18.6	16.8	19.1 13.6 12.4 1.7 14.2 13.1 19.2 28
14	17.6	9.5	88.8	17.7	14.4	24.5	12 38 60.9 49.9 172.7 87.8 118 111.7
15	60.3	96.4	14.7	232	143.5	105.4	193.6 129.2 63.1 4.2 52.2 36.3 27
16	47	38.6	13	0.4	8.9	7	3.2 5.4 9.3 7.1 2.6 16.7 7.6 4.3 7.8 5.9 5.7 3.
17	5.6	2.7	9.5	3.6	3.5	2.5	5.8 4.4 2.6 10.3 3.2 11.6 9.8 4.3 5.8 4 4.1 4
18	23.4	9.5	22.6	18.2	11.8	29.9	22.4 19.4 27.5 9.6 54.6 29.7 57.4 44.
19	24.1	17	3.7	24.1	14.8	12.7	22.4 32.8 22.7 2.7 26.3 19.3 28.8 31.3
20	15.3	23.2	21.2	4.9	20.8	24.2	20.8 36.6 29.1 76.9 35.5 44.4 67.8
21	81.3	78.4	82.7	26.4	123.3	86.6	154.7 77.6 39.4 48.5 25.8 76 60.7
22	45.9	80.9	18.8	17.7	14.3	30.4	26 32.4 26 21.3 9.5 90.6 22.6 11.4
23	37.7	13.5	46.4	30.8	30.6	104.9	59.2 44.5 49.8 30 17 13.1 67.1 29
24	22.9	30.4	13.6	12.1	0.4	23.5	11.5 6.6 11.5 0.3 0.6 2.8 5.7 2 0.1 2.2
25	2.1	0.3	0.6	3	1	3.4	1.4 6.1 3.9 10.7 8.9 3.8 14.8 4.3
26							
27							
28							
29							
30							
31							

Total	869.1 699.9 633.3 1293.9 823.1 1027 1026.2

1840

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1957 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	4.9	3.4	0.8	2.9	7.3	1.7	2.8
14	14.4	6.2	2.5	9.4	4.4	3.5	0.9
15	29.4	4.4	45.2	0	7.3	0.2	26.9
16	10.2	7	6	2.5	12.7	4.6	13.9
17	0	0	0	0	0	0	0
18	3.7	2.2	0	5.4	0	0	1.1
19	2	0.7	5.8	2.5	20.5	5.6	3.5
20	1.2	2	2.6	36.3	11.1	25.4	12.4
21	23.5	23	11.2	8.8	15.1	13.1	10.9
22	1.9	4.6	14.2	9.7	26.2	1.2	1.4
23	15.3	8.4	14.9	0.3	3.2	11.7	1.6
24	0.6	3.3	13	5.6	9.2	5.1	7.4
25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12							
13	1.6						
14	50.2						
15	17						
16	0						
17	19						
18	6						
19	0.5						
20	7						
21	3.8						
22	0						
23	10						
24							
25 26 27 28 29 30 31							

Total	167.2 175 133.2 252.6 269.2 166.6 256.1

1841

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1957 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1842

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1958 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1843

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1958 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 0 0 0 1.2 0 0 0 0 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 1.4 0.8 0 0.2 0 0 0 1.8 0 0 0.3 0 2.2 0 4.9 0 0 1 0 16 0 0 0 0 0 0 0 0 0 0 0 0 1.4 4.1 0 0 0.8 0 0.7 0 0.4 0 0 0 0 10.5 0 0.3 0 6.5 6.7 0 5.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 1.8 0.8 0 2.4 0 2 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0.4 0 5.9 0.3 2.7 0 5.8 4.8 0 1.1 1.6 0 0 4.7 5.1 5.6 3.4 6 2.4						

Total	3.1 28.6 11.1 12.1 22.5 7.9 47.4

1844

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1958 : Month - June							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1.7 3.3 0.3 3.1 1.5 0.1 1.1 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 24.4 8.8 5. 15.6 7.7 1.4 5.9 4 1 28.8 10.7 3.5 6.1 4 13.9 5.1 7.6 11.3 4.9 10.3 4.8 4 2 47.7 0.5 0.4 12.8 0.3 46.4 28.7 13.6 51 27.4 41.7 30.3 13. 6.9 133.6 38 15.2 33.4 18.2 109.9 47.3 60.4 112.3 53 102.9 59.1 63.9 28.3 77.1 76.1 35 75.5 51.3 121.6 81.1 48.8 117.6 74.2 65.7 78.7 69.7 30.3 67.2 40.6 24.2 56.9 30.7 49.4 37.9 20.2 111.4 65.8 85.7 83.5 24.4 49.8 33.2 80.3 60 102.9 55 121.5 97 44.3 160.4 103.7 78.7 122.7 87.8 113.5 135.5 134.4 90.9 66 105.7 178 86.5 130.3 74.4 49.6 187.6 73.7 117.3 41.3 53.8 61.2 32.6 74.6 36.4 87.7 52 114.5 138.5 69.4 94.7 80.3						

Total	1139.6 721.4 1022 1237.4 719 1097 841.7

1845

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1958 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	4.9 2.9 26 7.1 5.7 12.9 6 38.8 16.6 63.3 37 18.6 37 18 20.3 21.2 25.8 46 23.9 54 30 9.2 3.3 2.8 11.8 5 19.3 7.1 11.1 8.2 1.1 30.9 12.9 1.5 15.5 1.6 0.7 34.8 2.4 0.9 4.4 1.2 24.6 6.7 172.6 8.3 3.7 37.8 7.3 73.1 19.2 9.5 35.6 14.4 85.5 24.5 1 0.1 0 0 0 2.6 0.2 0.5 9.1 2.2 0 1.9 3.4 0.4 9 3.4 13.4 11.4 4.6 7.2 5 32.6 19.2 91.7 44.6 22.2 33.3 32.1 69.6 42.8 35 87.5 39.2 74.6 57.8 21.9 9.4 45.1 10. 5.7 32 14.2 79.5 30.5 45.2 39 21.7 52.5 25.2 56 51.7 70.2 53.3 34.7 63.1 33.6 44.3 56.9 8.1 174.8 83.8 91 98.5 9 11.5 26.7 17.9 14.7 18.9 25.2 21.6 27.2 20.1 34.3 23.9 28.1 43.2 40.7 21.5 36.7 33.3 18.2 35.2 35.5 19.4 25.1 72 34.4 18.4 37.9 18.5 32.3 10.3 45.2 39.9 15.7 57.6 20.1 24 10.8 96.2 85.7 45.3 117.5 54 49.2 23. 99.8 97.2 44.4 140.2 62.6 75.9 52 27.6 23.6 22 73.6 30.7 32.7 28 16.3 27.2 20.2 21.9 19.2 15.9 15.8 10.4 34.3 18.5 32.5 31.8 14.2 13.9 16.1 33.5 15.7 31.6 27.8 19.8 16.4 12.8 42.9 18.7 24.9 25.9 44.3 30.8 12.5 23 18.4 21 14.4 29.3 28.5 32.3 52.1 30 29.8 40.4						

Total	926.3 618 1171.5 1179.2 623 1282.8 825.9

1846

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1958 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 2.2 0 13.4 4.9 0.2 6.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0.7 (1 10.1 8.7 22.5 9.3 10.1 20.4 25.8 24.7 2.7 3.4 13.8 0.1 2.4 0 0 38.8 0 0 16.2 0.9 24.4 16.7 23.7 24.9 29.1 23.8 17.5 17.7 24.9 22 53.5 45.7 40.5 38.1 22.9 17.1 2.3 33.8 19.2 16.7 18.6 0.2 0 0.7 1. 0.5 1.3 1.6 0.2 0.8 0 1.9 0.8 2.2 0.7 0 1.6 0 0 0.3 1 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0.3 0 0 1 0.3 3.7 0 0.1 1 0 30.3 13.8 1.2 4.9 6.7 1.5 7.4 0 0.3 0 7.9 2.7 0 3.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0.5 0 0 0.1 0 0						

Total	123.8 114.4 105 167.6 133.5 115.3 117.1

1847

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1958 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.9 0 0 0.2 0 2.9 0						

Total	0 0.9 0 0 0.2 0 2.9

1848

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 19 59 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1849

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1959 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 1.8 0 0.9 2 1.7 2.4 0 2 0 0 0.5 0 7.7 0 0.6 0 0 0.1 0 5.5 0 0 0 0 0.5 0 6.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 3.6 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4 0.4 0 0.8 0.4 3 0 0.2 0 3.7 3.7 0 6.4 0 0 0.5 0 0 0 0 0 19.9 0 0 3. 0.1 2.5 0 0.1 0 2.8 0.9 0 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0.3 0 0.2 8.4 3.6 0.2 0.1 13.9 3.7 0 0 0 0 0 0 0 0 0 0 0 0 6. 0 0						

Total	8.4 33.7 1.1 7.5 37 5.9 35.8

1850

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1959 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	3.4	3.8	0.2	55.3	19	6.4	21.6
12	31.3	20.4	8.5	8.4	7.6	43.9	19.7
13	72.8	51.9	30.3	45.4	25.5	63.4	30.7
14	30.7	13.1	7.3	23.4	6.5	41.2	9.9
15	53.2	28.3	10.5	16.7	10.8	48.4	14.8
16	31.2	27.5	11.8	15.5	18.1	26.6	17.8
17	11.1	3.5	16.5	2.9	1.7	2.8	1.3
18	1.6	0.8	2.2	0	0.3	0.3	0
19	2.4	0	0	0.3	0.8	6	2
20	7.2	2.5	8.4	22.6	15.1	35.8	26.1
21	38.9	35.7	74.7	25	135	206.5	69.1
22	64.6	172.9	81.5	83.6	40.9	53.8	27.4
23	46.1	23.7	21.3	38.3	44.4	40.3	65.1
24	132.8	159.4	280.5	154.2	166.8	167.9	65.9
25	178.8	129.9					
26							
27							
28							
29							
30							

Total	1211.7 651.6 1263.2 1480.4 890.6 1216.3 963.8

1851

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1959 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	19.1	25.2	12.7	28.8	19.2	15.4	16.7 25.7 19.5 5.4 41.1 29 26.1 34.
12	15.6	8.7	5.7	12.7	12.5	11.1	14.9 32.2 28 9 16.8 25.9 14.6 18.9 76.
13	42.9	17.7	42.8	36.6	22.3	27.4	105.8 67.5 18.9 90.4 54.6 33.2 48.2
14	26	26.3	13.1	17.9	22.3	19.2	30.9 20.6 25.8 11.6 32.2 28 9.7 29.3
15	10.6	29.5	3.1	65.4	39.6	14	38.2 19.9 17.5 6 20.5 21.1 12.1 21.4
16	14.6	13.5	2.6	14.6	12.5	3.5	13.6 7.5 8.2 2.5 12.7 9 4.9 8.6 10.6 6.
17	1.5	14.1	6.8	5.3	8.3	4.6	3.1 5.5 2.6 2 3.7 2.4 6.1 2.5 0.3 4.3 2.1 0
18	1.6	0	0.3	0	6.1	2.1	1.6 2.5 4.1 2 0 1 0.9 1.2 0.4 2.6 2.5 3.2 2.2 1.1
19	1.9	4.5	5.7	3.5	4.9	20.3	7.4 8.1 8.1 13.9 8.8 26.7 22.3 12.7 17 14.
20	59.3	27.2	37.3	39.2	25.5	33.1	41 153.2 66.6 95.3 103.2 52.7 52.1
21	78.6	65	49.9	33.2	120.2	54.7	30.4 68.5 53.4 39 23.8 40.8 29.7 37
22	36.4	20.2	23.4	19.9	35	24.7	33.2 23.7 25.9 42 17.2 39.5 31.5 31.7
23	36	7.9	25.5	7.5	27.4	15.8	13.5 27.7 6.6 9.6 10.2 17.5 13.2 25.4
24	27.9	27.2	13.6	26.5	20.2	11.4	39 23.3 31 18.9 29.5 31.6 17.2 35 2
25	24.5	29.4	27.2	78.8	45.6	44	65
26							
27							
28							
29							
30							
31							

Total	895.6 687.1 478 1022.2 667.4 599.8 797.6

1852

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1959 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	7.9 2.5 3.2 2.7 1.5 4.7 3 8.5 3.5 1 3 1.9 3.6 1.3 0.6 0.5 3.2 3.3 1.2						
15	4.2 2.6 0.8 1.1 1.8 1.6 0.7 1.3 0.7 0.5 0.8 1.3 9.8 6.1 0.2 3.8 0 0.9						
16	20.8 7 0.1 8.1 0.3 0.1 0 0 0 0.5 0 0 0 0 0 0 0 0 1.2 0 27.8 9.4 0.9						
17	10.8 2.8 1.9 0 0 0.5 2.2 0.8 3.1 0.6 4.1 5.8 3.1 3.9 4.8 2.8 0.7 18.9						
18	2.8 1.3 20.3 12.9 3.1 0.6 0.8 0.4 0.1 5.9 0.5 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 9.4 2.6 4.2 0.2 0.8 0 0						
20	0 0 0 0 0 0 0 2.4 20.6 0.2 0.1 12.9 0 13.1 0 0.5 0.4 2.3 2.7 2.9 0.9						
21	16.7 8.6 6.2 4.9 5.4 1.3 4.8 0.6 1.5 0.8 0.1 0.3 0.5 0 0 0 0 0 0 0 0.						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	59.5 48.2 46.1 85.6 54.9 52.5 68.2

1853

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1959 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.4 0						

Total	0.4 0 0 0 0 0 0

1854

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1960 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1855

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1960 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 2.7 0 0 0.5 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	5.9 0 9.7 4.3 0 3.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0.9 0 0 0.2 0 2.2						
21	0 0 0 0 0 3						
22 23 24 25 26 27 28 29 30							

Total	0.1 9.5 0 9.7 5 0.9 9.4

1856

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1960 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0.1 0 0 1.2 0 0 0 0 0 0 0.8 0 0.1 0 1.1 0 0 1.5 0 0.3 0.7 0.1 0 0 3.9 0.4 0.5 0.2 8.1 3.3 1.1 6.4 1.7 12.7 3.8 11.5 32.4 10.3 20.2 16. 11.7 6.2 17.3 4 2.3 21.5 2.3 86.8 28.4 78.1 41.4 20.1 99.4 24.4 25 8.4 28.2 21.2 8.9 32.1 10.4 12.4 4.2 8.4 13.4 4.7 12.5 5.4 18.9 4.3 12.6 18.9 7 4.3 6.9 57.5 23.2 17.9 85.2 32.8 42.6 37.7 99.2 33 128.9 68.5 31.5 134.7 42.6 41.3 20.2 73.7 40.6 20.5 100 28.6 23. 19.7 17.4 88.9 36.1 22.8 41.6 13 8.5 5.5 12.1 5.6 4.5 6.9 8.1 4.9 4.8 11.7 6 23.5 8.2 34.4 22.9 30.6 26.8 15.4 53.1 26.8 32.9 15 14. 24.9 11.8 11.6 15.1 15.5 6.6 7 4.1 3.7 6.1 1.9 19.8 6.1 17 22 8.3 14.2 10.5 58.3 25.9 23.2 28.3 17.4 39.9 18.3 13.8 27.1 78.6 41.2 20.9 27.3 24.5 5.2 34.6 8.5 48.5 44.6 40.6 43.9 9.1 12.1 8 12.7 19 16 15.1 15.2 13.6 6.1 21.3 13.1 6.6 15 39.8 46.1 27.8 50.1 38.3 38.9 35.7 119.8 71.1 91.6 196.8 108.3 173.9 118.2 123.8 79.4 62. 108.8 71.7 41.7 86.4 37.7 48.5 26 58.9 72.3 35.4 73.1						

Total	936.4 574.7 815.5 1086 631.8 1037.2 718

1857

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1960: Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	12.6	16.5	16.3	25.3	18.6	34.5	34.6
12	57.6	26.3	23.7	30.1	80	46.5	34.4
13	14.8	33	48.1	38.2	12.9	42.6	26.8
14	24.3	33.8	29.3	31.6	26.8	28.3	46.1
15	38.3	21.5	24.8	22.9	62.5	41.1	39
16	53.8	37.9	34.7	32.3	27.7	15.7	24.6
17	20.4	28.4	42.2	23.6	31.2	30.4	32.7
18	7.5	7.3	31.8	15.7	23.8	21.2	12.4
19	18.4	4.8	20.5	15.3	19.3	19	33.2
20	9.6	29.5	21.1	21.5	24.8	27.5	26.2
21	10.8	9	17.9	8.9	6.4	14.9	5.2
22	4.8	10.7	3.4	2.6	5.9	0.8	8.4
23	4.5	1.9	0.8	4.8	2.1	2.6	4
24	10.9	4.6	12.6	6.7	1.7	0.9	0.2
25	1.7	0	0	0.2	0	0	5.6
26							
27							
28							
29							
30							
31							

12.6	16.5	16.3	25.3	18.6	34.5	34.6	67.5	44.2	34.6	65.9	39.7	25.4	
57.6	26.3	23.7	30.1	80	46.5	34.4	62.3	21.2	35.3	12.4	42.7	25.6	
14.8	33	48.1	38.2	12.9	42.6	26.8	26.2	31.8	30.7	18.7	17.8	39.6	
24.3	33.8	29.3	31.6	26.8	28.3	46.1	24.6	36.2	31.3	69.5	30.1	20.5	
38.3	21.5	24.8	22.9	62.5	41.1	39	88.6	49.4	37.9	52.3	71.9	62.5	
53.8	37.9	34.7	32.3	27.7	15.7	24.6	11.4	36.1	36.9	42.8	39.1	23.1	
20.4	28.4	42.2	23.6	31.2	30.4	32.7	19.4	14.6	38.3	19	24.2	22.6	5.
7.5	7.3	31.8	15.7	23.8	21.2	12.4	11.7	6.4	22.9	12.4	3.6	20.2	2.9
18.4	4.8	20.5	15.3	19.3	19	33.2	26.1	8.5	20.8	21	25.9	20.5	11.4
9.6	29.5	21.1	21.5	24.8	27.5	26.2	18.6	37.3	25.9	18.6	31.5	11.5	
10.8	9	17.9	8.9	6.4	14.9	5.2	3.9	3.5	5.2	3.5	8.7	4.8	11.6
4.8	10.7	3.4	2.6	5.9	0.8	8.4	6.4	4.9	8.1	1.4	8.5	1.8	19.6
4.5	1.9	0.8	4.8	2.1	2.6	4	4.5	4.2	12.2	5.8	5.2	11.9	6.2
10.9	4.6	12.6	6.7	1.7	0.9	0.2	2.9	1.1	2.6	2.8	2.8	1	0.4
1.7	0	0	0.2	0	0	5.6	0.6	1.1	4.7	1	3.9	2.1	3.3

Total	661.2 558.4 413.8 874.2 555.8 583.4 681.3

1858

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1960: Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0.4	0	0	5.6	0
15	12.2	6.1	4.9	27.8	10.3	4.8	10.7
16	2.2	7.9	2.3	0.2	2.5	20.4	7
17	3.1	0.6	12.1	8.9	2.8	5.9	5.6
18	0	0	0	0	0	0	0
19	8.3	2	2.6	0	4.7	2.1	0
20	0	0	0	0	0	0	0
21	0	1.2	1.2	0	32.2	10.1	8.2
22	11.5	4.7	2.4	3.8	3.2	8.7	19.2
23	0						
24 25 26 27 28 29 30 31							

Total	119.2 86.4 55.9 171.1 92.2 64.9 98.8

1859

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1960 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0						

Total	0 0 0 0 3.6 0 0

1860

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1961 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1861

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1961 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	10.6	0
17	0	0	0	0	0	3.3	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	1.1	0.4	2.8	0.2	0.2	0.7	0
21	2.8	0	0.4	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	20.1 21.4 15.5 2.5 11.4 4.9 12.8

1862

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1961 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	4.8 0 0.2 0.1 0 1.4 0 3.4 0.2 1.5 0.1 0.1 3 0.1 1.4 1.6 1.6 6.6 2.2 2						
12	3.1 0.7 0.5 0.2 3.8 1.2 0.2 1.6 0.6 1.3 0.5 5.6 1.7 31.6 4.5 58.9 16						
13	64.7 27.3 14.5 62.7 14.8 45.3 23.4 62.1 94.8 35.1 126.7 74.8 66.2						
14	26.5 122.6 85.5 35.5 69.2 51.6 21.9 3.8 40.1 23.7 8.6 45.9 13 19.						
15	7.1 33 3.4 2.9 25.3 6.4 19.3 4.2 21.9 4.2 4.6 12.7 4.7 18.6 4.7 11.8						
16	5.2 2.7 16.5 6.1 32.5 9.6 14.9 35.2 12.4 26.2 19.7 68.1 16.4 34.3						
17	49.4 18 52.4 36.3 21.4 0.9 10.2 2.4 3.1 15.8 2.1 29.1 19.2 61.6						
18	25.4 12.1 41.4 12.7 11.4 1.6 8.6 4.2 1.5 4.2 2.5 0.7 1.5 0.2 0 0.4 3						
19	0 6.3 6.4 17.4 24.6 8.5 15.6 11.4 31 10.8 18.8 24.9 9.6 16.8 10.9						
20	14.2 3.6 26.7 22.5 8.2 19.6 20.6 11.2 5.6 37 17.5 6.2 28.2 16.7 31						
21	11 42.4 26.9 12.7 42.3 29 50.9 24.7 33.9 59 26.5 39.3 33 16.2 27						
22	53.9 101.8 55.2 98.4 73.3 174.7 103.6 143.2 142.7 100.5 118.1						
23	123.3 38.3 7.9 25 12.2 6.9 24.1 7.5 97.6 18.9 37.3 35.5 16.9 35.9						
24	15.3 100.7 19.2 74.6 31.7 13.9 71.5 18.4 141.5 48.4 72.7 107.2						
25	35.4 90.6 51						
26 27 28 29 30							

Total	1137.6 426.2 1072.9 983.4 457.1 1141.6 664.4

1863

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1961 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	47	24.9	16.3	39.3	20.1	13.7	19.9
12	30.6	13.8	55.8	41.4	12.6	30.5	19.5
13	9.4	4.2	24.5	14	4.9	18.2	13.1
14	8.5	16.9	8.2	17.6	6.7	11.6	2.9
15	13	19.6	12.2	4.9	6.4	5.9	12.9
16	24.1	20	35.6	48.2	36.2	130.7	59.7
17	21.1	35.5	23.6	94.9	35.3	78.9	77.8
18	205.8	94.3	89.9	132.6	49.5	59.2	35.3
19	47	56.4	41.4	43.5	63.6	33.7	30
20	47.1	99.2	52	46.3	76.8	7.8	22.4
21	2.8	13.5	5.3	19.4	5.8	13	3
22	17.5	56.5	10.6	12.2	2	56.6	31.9
23	20.3	12.4	23.4	13.6	40.7	22.1	16.8
24	18.3	34.8	2.4	4	9.3	19.8	14.8
25	10.4	2.4	4.8	1.7	2.5	3.4	2.8
26							
27							
28							
29							
30							
31							

Total	731.3 703.6 609.4 1353 805.9 773.1 1114.2

1864

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1961 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	5.9 2 1.4 2.4 1.3 0.6 0.8 8.5 2.5 17.6 2.7 1.4 5.4 1.1 1 0 0.2 1 0.3 0.4 0 0 0 0 0 0 0 38.1 5.4 29.2 4.5 26.1 7.3 5.8 4.7 0.8 0 6.6 12.6 0.6 8.1 8.9 4.4 1.8 11.9 4.4 2.4 6.8 9.4 8.3 6.8 20.2 14.4 4.6 9.1 13.9 8.4 13.1 3.1 3.2 8.5 5.9 1.2 3.4 1.9 6.3 3.9 8.9 6.4 0.3 0.4 7 3.8 1.1 4.4 8.2 0 0 0.2 0 0 0 0 0.4 0.5 0 5.6 1.7 0 2.5 0 0 0 0 0 0 31.7 3.6 18 21.5 10.4 12.6 0.4 0.8 0 0 0.2 14.4 2.2 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 16. 19.5 3.6 15.6 9.6 0.8 6.6 0.4 0 1.2 0 1.2 0.3 0 0 0 0 0 0 0 6.8 14 0.4 4 25.1 8.2 10.6 11.5 5.5 4.1 30.6 10 14.4 21.7 10.1 9.1 7.4 7 4 9.5 11.4 5.4 3 6.5 2.2 1.4 2.8 1.4 2.5 1.8 29.7 8 0.2 8.4 0 1.9 0 0.1 0 0 0						

Total	156.4 122.1 135.8 153.5 143.9 111.9 122.6

1865

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1961 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1866

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 27.7 7.3 9.2 12.1 5.6 1.8 4.2 13.2 5.6 10.7 22.4 7.9 2.5 9.2 3.4 1.2 0.4 0.4 0.5 0 0 0.8 1.1 0.1 11.2 3.4 0 4.9 17.4 6.3 7 4.1 3.2 1.6 0.8 0 0 8.3 0 0 2.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 0.3 0.2 3.4 1 0 1.4 8.3 2.2 2.8 5 2 0.5 1.9 13.2 1.2 3.4 0.8 0.5 0.6 0 4 10.7 38.2 0.7 3 10.3 4.9 0 0 0 0 0 0 3.9 0 9.8 0 0 2.6 0 0 0 0 0 0 0 0 0 0 4.1 0 0 1.1 0 2 0 18.9 0.2 0 5.1 0 6.8 1.2 0.9 7 1.7 0 0.8 2 34.7 9.9 0.2 9.3 2.7 0 4.2 7.6 0.5 0.5 2.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	105.2 89.2 115.4 68 43 28.5 32.2

1867

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962: Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.5 0 1 4.7 0 0 0.6 1.4 0 0 7.8 7.6 0 2.1 2.1 0 0.2 16 0 3.2 4.6 0 1.4 3.3 3.2 5.3 7.4 2.5 1.4 3.1 10.7 2.8 1 11.3 8.8 0 4.8 0 0 7.8 0 2.6 2.1 0 3.7 0 0 7.1 0 0.1 9.8 0 0.7 0.4 2 2.4 0 0 4.2 0 0 4.7 1.8 0.2 0 0.6 0 0.2 0.2 0 0 8.6 3 0 2.3 3.3 0.3 9.8 0.6 0.7 0.4 0.2 0 0 0 18.5 0 0 4. 0 0 0 9.3 0 0 2.2 0 0 0.5 0 0 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0 0 0 0.8 0 0 0 0 0 0 1 1 2.9 0 0 0.8 0 0 0 0 0 0 0 0 0 1 8.8 0 0 0.6 0 0 11.6 0 0 3 0 0 0 0.8 6.8 0 2.9 1.9 0 1 0.4 0 0 0.1 0 0						

Total	38.3 104.5 32.9 22.7 62.3 17.2 13.1

1868

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	10.7 1 0.9 10.9 3.2 0 4.6 0 0 0 0 0 0 0 0 0 0 5.4 0 0 0 0 0 0 2.5 0 0 0 0 0.2 0 0 1.3 0 0 0 0 0 0 21.6 3.1 0.3 0 0 0 0 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 2.2 0 0.2 0 0 0 0 16.9 8.4 3.8 0.9 25.9 8.2 1.3 11.1 0.8 1 0.1 10.7 3.2 0.3 4.7 0.7 1.5 0.1 9 2.7 0.8 4.4 1.7 1.1 0.2 0.2 20 0.8 0.1 0 0 0 0 0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0.4 0.1 0.1 0.2 0 14.7 0 0 0 0 0 0 0.2 0 0 0 0 0 0.9 0 0 0 0 0 0 2.8 0.1 20.1 6.7 1.5 0.8 1.8 15.7 0.2 1.6 2 0.3 21.2 9.2 0 9.3 10.7 6.3 1.2 65.8 28 0 28.8 8.6 0.8 0.7 8.9 2.6 3.2 4.2 4.8 11.6 0.4 2.6 3.8 0 3.1 1 0.4 0.1 0.1 0.2 0 0.6 2.7 1 0.3 0.3 0.4 0 0.8 3.3 2.3 0.4 17.3 5.4 0 7.5						

Total	76.1 40.3 7.2 173.8 120.8 29.7 113.9

1869

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 35.2 26 0.2 8.7 10.5 3.6 1.3 47.9 21.9 0.3 12 17.6 3.9 3.8 57 0.4 0.5 14.5 0 0 0 63.3 4.5 0 17.6 2.3 9.5 0 71.1 0 0 20.3 1.6 2.1 8.9 136.6 26.1 1.3 34.7 22.2 8.6 15.2 11.4 17.5 2 7.3 17.4 2.1 59.8 84 144.2 8.3 26.1 38.4 3 8.2 68.5 102.6 2.9 17.8 29 0.8 18.2 69.3 22 27.7 30.9 11.2 15.1 2.7 60.5 0.2 1.6 15.6 5.6 2.9 11.2 80.6 7.9 0.5 20 15.8 8.8 56.6 58.7 182 8.6 22.2 56.9 12.3 6 19.5 46.4 0.8 5.1 17.2 5.3 19.2 21.2 18.6 3 8.5 44.8 8 2.1 58.4 35.7 0.6 14.7 16.7 2 0.6 31.3 1.2 1.9 8.3 16.7 2.9 3 31.8 5.7 1.2 8.4 5.6 0.8 14.4 22.2 25.9 2 6.8 7.9 0 10.5 6.8 18.3 1.4 2.6 5.8 0 0 0 1.5 0 0 0.4 0 0 0.2 15.7 0.1 2.8 10.5 0.8 0 2.6 0 0 7.1 0.9 0 0 2 2 0 2.4 1.5 0 9.2 54.5 10.8 1.2 20 2.8 0 8.9 31.6 11.3 1.2 8.6 4.2 0.1 15.9 54.9 161.6 3.3 14.9 49.4 0.8 28 67.8 105.4 6.5 45.7 41.9 1.7 0 13.4 4.2 0 3.3 10. 0.4 30.6 11.7 9.2 3.8 5.6 8.2 0 20.7 17.9 4.3 2.6 6.3 3.4 0						

Total	355 1292.5 1033.3 83.5 418.8 476.6 95.7

1870

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	3.3 1.4 0.4 0.4 0.5 6.6 0.8 3.4 7.1 0.4 0.4 2.1 1.8 0 0 4.6 0 0 0.9 0 0 0 5.1 0 0 1.1 0 0 0 3.9 0 0 1 0 0 0 1.5 0 0 0.1 0 0 2.1 12.7 11.3 0 22.2 3.1 1.9 0.8 0.6 20.9 0.3 1.3 8.4 4.3 0 1.6 8.3 0 0.4 3.2 16 0 22.8 12.9 0.1 5.6 3.5 8.9 0 8.5 0 0 1.7 0 2.4 2.2 0.9 0.2 0.3 0.3 0.9 0 0 0 0 0 0 2 0.3 0 8.7 0 0 2 0 0 0 18.5 0 0 4.5 0 0 1.6 2.4 15.9 1.5 0.8 4.3 0.5 0 0.9 0 0 0 0 0 0.9 7 1.5 0.1 1.7 0.4 0 1.2 7.2 4.3 0.2 5 1.3 0.9 0 14.5 0 0 3.7 0.1 0 2.2 3.3 9.5 0.4 0.9 3.2 0 1.9 1.8 10.8 0.3 0.5 3 0 0 12 0 0 2.7 0 0 0 4.8 0 0 1 0 0 0 6.9 0 0 1.6 0 0 0 9.7 0 2.4 0 0 4.6 7.3 18 0.7 6.1 7.5 0.3 8.5 89.7 15.1 1.2 54.5 5.4 22.9 0.1 22.3 18.5 0.2 5.9 9.3 0.4 0 0.2 0 0 0.8 22.2 6 0 10.5 0 0 2.8 41 5.5						

Total	32.8 298.4 148 6.5 134.6 127.5 71.1

1871

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1962 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0.4 0 2.9 0 0 0.8 0 0 2 18.9 12.3 0.1 14.8 60.6 18.3 17						
16	2.4 90.4 1.2 3.1 63.3 21.6 51.2 9.5 30.4 2.5 6 33.1 13.7 34.6 19						
17	70.2 23.9 11.6 65.8 21.3 1.8 2.5 0.3 22.5 6.9 0 9.9 3 3.8 0.5 40.3						
18	12.1 0 17.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23 24 25 26 27 28 29 30 31							

Total	109.9 59 204.1 90.5 55.3 222.8 102.9

1872

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1963 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 8.2 0 0 0 0 0 0 4.2						

Total	0 0 0 0 0 0 12.4

1873

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1963 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0.4	0.5	0	4.7	1.4	0	13.3
16	0	0	2.6	0	0	0	0.3
17	0	0	0	0	0	0	0.7
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	1.9	0	0	10.4	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.4	0.5	0	4.7	1.4	0	13.3
16	0	0	2.6	0	0	0	0.3
17	0	0	0	0	0	0	0.7
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	1.9	0	0	10.4	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.4	0.5	0	4.7	1.4	0	13.3
16	0	0	2.6	0	0	0	0.3
17	0	0	0	0	0	0	0.7
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	1.9	0	0	10.4	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.4	0.5	0	4.7	1.4	0	13.3
16	0	0	2.6	0	0	0	0.3
17	0	0	0	0	0	0	0.7
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	1.9	0	0	10.4	0	0	0

Total	1.9 36.9 0.5 14.1 23.4 0.1 20.7

1874

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1963 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 1.5 0 0 0.4 0 16.9 0 1.2 0.6 0 1.2 0.5 45.9 15.2 6.1 5.6 5.2 16. 8 37.9 3.9 43.7 32.7 14.5 32 20.6 21.2 2.4 35.9 17.1 9.8 24.6 10.4 31.9 17.3 70.4 53.3 19 46.6 34.3 41.5 13.9 79.4 34.8 17.4 36.4 21.7 31.6 3.7 43.1 22 8.8 31.2 16.9 29 15.4 44.6 33.7 15.9 138.5 68.2 37.7 32.9 58.8 168.4 68.1 101.3 111.9 55.2 23.8 64 28.7 14.9 47.9 20.1 29.7 0.8 18.8 7.1 2.6 10.8 9.4 5 3.8 4.7 20.7 6.7 5.7 11.5 17.1 1.9 13.3 9.8 3.1 9 30.5 2.5 2.2 0.3 2.9 1.4 3.6 2.3 0.9 7.9 3.4 1.9 2.6 39.3 44.3 8 14.6 19.5 48.6 34.1 87.5 56.7 40.1 30.8 44.7 53.3 28.7 77.1 77.1 55.5 34.2 90.7 96.8 49.6 64.4 59 26.5 13 27.7 32 13.4 39.6 26.5 17.9 5.4 13.7 36.1 13.8 20.4 23.2 10.1 0.5 19.8 2.8 0.8 15.3 4.6 5.7 23.5 4.8 4.8 7.6 39.4 23.9 13.5 17 25.3 55.7 23.1 25.4 30.6 7.8 4 51.8 10 3.7 16.9 5.3 13 2.1 3.3 3.2 1.4 6.6 3. 12.6 0.7 23.4 4.8 2.7 25.3 10.8 6.5 2.7 9.1 9.6 3.3 8.3 7 18.1 12.2 16.2 36.7 18.4 41.9 37.3 10.7 15.3 10.8 56.9 25.1 7.1 30.8						

Total	650 321.1 850 890.6 415.7 1020.2 807.3

1875

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1963 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	60.1	24.3	44.9	49.9	47.7	29.7	37.3
12	16.8	10.5	15	35.3	14.1	72.5	47.9
13	45.5	41.1	39.3	35.7	99.7	48.9	54.1
14	78.8	64	49.3	40	47.3	14.3	23.6
15	24.2	14	21	7.2	10.6	19.7	20.6
16	27.7	28.1	26.3	12	33.8	29.5	29.4
17	57.5	93.7	78.2	58.1	122.2	88.2	68.1
18	52.8	54.1	59.3	52.3	64.2	84.4	53.8
19	28.8	23.8	26.1	39.3	33.1	21.4	22.6
20	78.6	56.3	63.9	63	60.2	54.9	58.3
21	43.1	21.1	64.6	41.6	65.3	26.3	56.7
22	87.1	42.2	22	56.9	34.2	29.4	10.9
23	51.4	59.9	25.5	65	45.5	50.4	23.7
24	34.4	27.4	47.8	33.5	38.7	19.1	67.8
25	8.8	88.6	42	15.3	55.1	1.5	2.3
26	4.1	6.2	1.1	1.6	2.8	8.9	2.9
27							
28							
29							
30							
31							

Total	1206.4 950.4 1112.6 1457.2 945.2 1360.5 1264.4

1876

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1963 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0.5 0 0 0 0 1 0.5 5.1 32 0.6 20.5 15.4 8.3 16.9 0 0 0 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.9 2.5 0 0 1.3 0 0 15.6 6.9 0 3.9 30 0.3 6.3 11.2 3 15.3 5.3 3.1 19.7 6.9 11.5 18.6 2 1.2 0. 10.3 5.3 25.5 18.4 13.9 3.6 10.2 10.8 14.5 25.8 18.5 11.4 5.7 14.4 31.3 12.6 12.4 21.6 0.9 1.1 2.7 0.1 0.9 1.8 1.1 0 0 0 0 0 0 0 0 0 (2.8 12.3 5.8 0 0 0 0 1.4 1.9 1 0.4 2.3 20.9 5.8 2.2 7.6 6.1 2.2 24.9 3.7 0.1 20.9 28.5 12.7 5.5 5.3 11.7 5.8 15 13.9 8.1 1.5 3.6 0.1 0 3. 19.5 10.1 1.7 10 1.5 0.1 3.6 3.8 1.6 7 9.4 1 9.1 8.5 22.7 16.6 27.6 61.7 11.7 194.7 69.9 15.4 112.4 3.3 2 5.4 16.5 5.1 1.9 10 12.5 5.8 30.1 10.2 4.5 8.3 12.2 0 0 0 0 0 1.5 0.8 0.7 0.2 0 0 0.1 1 0.8 0 0 19.7 0.2 0 5.4 1.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	111.5 178 168.4 335.5 199.2 261.7 308.1

1877

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1963 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1878

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1964 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1879

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1964 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0.8 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0						

Total	0 0.8 0 0 0.6 0 0

1880

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1964 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.3 1.3 0 2.1 1.7 0 0.4 0 0 0 0 0 8.3 0 0 0 0 0 0 0 0 0 0 0 0 0 5.5 0 0 0 0 0 0 0.5 0 0 10.3 0 0 7 0 7.8 0.8 36.3 4.9 0 22.9 1.3 34.5 3.8 18.9 8.6 0.5 42.9 3.9 55.4 32 89.4 84.9 11.5 76.4 31.4 13.4 12 31. 17.9 4.7 43.4 13.4 27.7 11.6 19.8 27.8 5.2 23.8 22.1 27.9 7.5 17.4 38.9 4.1 70.3 19.8 21.1 5.8 37.8 24.9 0.7 35.7 13.1 10.2 9.8 27.5 4.3 69.1 3.7 10.4 10.5 49.1 8 6 36.1 10.2 64.9 49.3 88.7 83 55.3 42.3 17.7 32.8 11.7 27 26 13.3 50.8 10.6 20 6.9 17.2 27.8 2.4 76.4 6.1 3.9 5.5 6.6 10.6 1.5 32.4 1.5 5.6 5.2 6 25.5 1.2 10.2 5.3 24.9 9.5 26.5 3.9 2.7 39.7 0.5 30.6 31.7 46.5 71.1 17.3 3.4 28.3 30.8 24.6 15.9 15.2 14.7 77.9 10.6 39.3 52.3 33.8 51.3 32.9 64.2 29.6 33 25.5 56.4 52.9 19.9 31.5 21.5 31.9 41.8 35.8 48.7 30.4 46.2 35.6 35.2 49.7 23.3 78.2 50.7 60.9 58.8 21.1 25.2 17.5 56.8 26.9 43.9 55.9 26.8 26.7 19.1 27.5 29.1 19.1 35.6 20.6 35.2 10.6 26.7 41.9 10.3 29.6						

Total	630.1 495.9 768.7 832.2 378.9 1050.6 467

1881

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1964 Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	51.6 35.7 44.3 61.5 16.1 58.3 16.7 47.2 25.5 68.7 55.5 19.2 126 37.5 45.3 42.4 60 49.8 36.2 81.5 44.2 52.4 43.6 83.8 61 35.9 70.6 61.7 57.9 94 53.7 116.3 86.2 119 72.4 111.3 75 84.8 144.4 77.7 9 107.6 126.1 124 69.1 131.4 131.6 138.2 106.4 21.4 76.7 8.7 25.3 66.2 54.5 75.8 27.2 81.8 22.9 38.9 60.9 23.5 55.4 26.4 46.2 8.2 24.2 33.5 10.6 27.6 25.7 58 19.2 38.1 51.8 39.8 56.5 27.7 61.7 26.6 70.9 59.8 41 81.9 19.1 20.5 14.6 47 21.2 13.5 45 25.3 15.4 16.5 26.4 11.1 24.2 21.3 4.7 4.6 1.1 2.2 2.8 1.1 3.3 1.8 1.3 1.8 6 2 3.8 3 21.2 14.8 15 22.3 10.5 20.4 14.8 25 23.2 13.6 21.2 16.2 26. 20.8 40.8 19.1 15.9 52.9 12.4 40.9 44.9 18.8 34.4 8.2 31 24.5 17. 23.6 22.9 18.9 14.5 25.2 10.3 16.9 20.4 11.9 10.7 7.6 6.6 6.1 14 5 17.9 16.8 9.8 19 11.8 20.5 17.3 49.9 17.9 11 32.3 14.5 12.4 23.1 68.1 51.4 32.5 45.2 31.2 34 37.7 17.9 14.8 5.7 14.3 6 3.7 11.5 19. 6.4 6.6 8.2 4.1 1.6 9.6 3 6.2 9.5 6.1 4.8 9.7 10.3 25 6.8 3.3 7.2 2.6 5.9 5.2 4.9 1.2 3.2 5.3 0.4 6.8 2.8 0.9 1.6 5.2 0.2 0.4 6.3 0						

Total	1018.9 1050.6 745.6 1195.9 868.2 1140.8 1063.3

1882

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1964 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	29.6 13.6 34 28.8 13.1 51.5 16.6 53.9 17.5 48.8 30.7 12.2 35.6 9. 26.2 25.4 30.2 93.9 19.6 56.4 28.1 19.2 11.7 44.2 35.6 11.4 35.4 16.1 7.6 4 0.1 3.9 5.3 0.4 3.4 0 13.5 2.5 3.5 14.8 2.4 3.9 2.1 0.3 0 3.5 0 0 7.1 3.5 0.2 0 2.6 0 0.4 11.6 1.9 45.5 56.4 2.5 5.1 25 2.9 0. 0.2 0 1.5 0.1 0 0.1 0.7 0 0 3.6 0 1.6 0.2 0.8 2.1 3.4 14.8 0.2 7.8 0 0.8 0 2.8 7.9 0.4 0.7 0 0.3 1.9 0 3 4.8 0 16.9 16.2 6.5 44.9 8.6 20. 14.1 12.3 19.3 0.7 2.9 7.1 1 0.4 0.3 0.1 0 0 4.1 0 0 0.9 10.6 0 8.8 13.4 11.8 4.3 5.1 11.2 5.2 7.2 12.6 3.3 3.1 0 0 0 0 0 0 0 0 0.2 0 0.2 0 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.3 0 5.2 6.4 0 1.4 1.9 3.2 0 9 1.4 0 3.4 0.4 1.2 0 0.1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 1.1 0.7 8.5 1.6 14.3 6.6 0.1 4.3						

Total	199 170.2 223.7 352.3 177.9 229.4 147.8

1883

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1964 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.6 0 3.7 0 0 0.7 0 0 0.7 0 1.2 0.8 1.3 0.2 0.7 0.1 0 0.9 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	2.7 1.3 2 0.2 0.7 0.8 3.7

1884

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1965 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1885

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1965 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0.1	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	7.2	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	2.2	0	0	0
18	0	0	0	4.2	6.6	6.5	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	8.6	0	0	11.3
17	0	0	0	0	0	0	0
18	0	0	0	0.8	14.9	0	1.5
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	1.6	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	4.1	8.3	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	5.8	0	6.7
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Total	0 11 14.9 0 22.8 10.7 31

1886

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1965 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0.3	0	0	0	0	0	0
13	18.5	0	0.7	0	0	2.6	0
14	10.2	56.1	51.2	4.2	5.8	21.6	3.7
15	17.3	8.7	37.6	5.5	1.8	12.1	2.4
16	2.4	5.4	11	4.7	65.6	35.1	48.7
17	11.5	102	15.1	99.2	20.6	38.5	27
18	17.1	118.7	33.5	85.9	144.1	127.5	188.5
19	4.2	15.9	9.5	6.6	7.9	34.7	10.5
20	36	11.9	36.7	65.6	78.5	12.1	8.8
21	4.2	15.1	7.8	18	3.3	13.2	7.7
22	10.8	13	30.1	16	54.3	12.5	14.7
23	34.6	43.8	16.5	60.4	43.1	10	75.6
24	15.1	64	19.1	75.3	66.3	9.4	59.9
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0.1	0
13	0	3	16.1	22.3	58.7	11.3	
14	4	6.3	1.1	6.2	2.3	5.7	1.1
15	1.3	8	1.1	5	2.1	27.1	9.5
16	35.1	20.8	15	45.3	11.3	36.7	31.6
17	7.1	39.3	10.2	59.7	31.4	160.5	80
18	127.5	188.5	87.3	78.9	114.2	50.2	20.2
19	9.5	38.9	9.2	31.5	29.5	102.2	16.9
20	12.1	8.8	12	9.3	5.3	17.6	22.3
21	7.7	12.5	17.3	21.2	28.3	2.3	18.4
22	14.7	17.9	15.3	14.2	68.7	86.6	8.4
23	10	75.6	16.4	43.1	17.9	43.2	22.2
24	9.4	59.9	24	103	16.4	58.2	54.5
25 26 27 28 29 30							

Total	1141.7 552 981.1 872.4 275.3 1002.9 545.6

1887

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1965 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	52.7	43.6	14.5	33.2	24.7	22.9	35.3
13	42.4	29.9	13.6	0.6	12.7	6.7	4
14	0	3.9	4.3	2.9	4.5	5	1.5
15	5.1	5.3	3.4	8.9	13.8	1.5	16.5
16	1.9	0.1	1.7	8.4	1	14.8	15.9
17	3.8	23.1	22.2	0.2	39.7	11.3	1.8
18	0.8	0.7	19.6	5.4	24.8	5.6	36.9
19	2.8	18	9.3	22.7	7.5	40.4	20.9
20	8.4	9.7	58.6	21.7	25.3	26.7	4.7
21	3.9	51.1	45.1	28.6	64.5	34.8	22.6
22	13.3	23.6	16.9	24.3	26.6	7	12.1
23	16.7	23	15.7	3.7	21.3	8.6	5.4
24	0.9	8.7	1.9	3.8	7.2	11.9	5.8
25	4.5	17.9	21	12.9	14.3	2.5	6.2
26 27 28 29 30 31							

74°E 15°45'N
13.4 8.5
4.1 6
6.1 16.3
4.9 0.1
6.6 5.1
0 6.3 1.4
27.2 14.8
4.9 25.1
15.6 38
28.3 12.8
20.1 6.5
5.3 9.9
12.4 1.5
9 7.4

Total	673.9 387.2 411.3 532.1 198.7 397 328.9

1888

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1965: Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0.2	14.1	0	0	9.9	0	0.3
16	2.1	10.8	0	1	2.9	0	0.2
17	0	0	0.8	4	0	0.4	1.1
18	0.6	0	8	1.6	0	3.2	0
19	0	0	0	0	0	0	0
20	1.8	0	0	0	0	0.3	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23							
24							
25							
26							
27							
28							
29							
30							
31							

1.5	8.1	0	9.7	2.5	0.2	3	0.7	3.6	3	3.5	1	1.4	2.5
0	0	0	0	0	0.1	0.7	0	0	0.2	0	0	1	5	0	0.5	3.5
0.5	2.7	0	0.2	0.7	0	0	0.4	2.1	0	0.2	0.6	0	0	1
0.4	0	2.7	3.2	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	5.2	2	0	0	0	0	0	0	9.7	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

Total	14 53.7 3 33.9 25.8 4.3 17

1889

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1965 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 11.9 0 0 11.3 0 53.6						
17	17.9 72.1 5.1 13.7 71.8 1.5 55.4 27.5 112 115 24.9 130.4 104.4						
18	54.1 12.2 37.6 16 6.5 38.8 32.4 35.5 5 28.8 8.6 2.5 5.6 7.7 2.9 4.4						
19	8 7.7 2.7 4.7 3.4 0.9 2.8 0 0.1 1.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23							
24							
25							
26							
27							
28							
29							
30							
31							

Total	202.4 70 270.4 152.5 52.1 262.6 149.4

1890

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1966 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0.6 0						

Total	0 0 0.6 0 0 0 0

1891

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1966 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0.1 0
16	0	0	0	0	0	0	0.5 0 0 0 0 0 0
17	0	0	0	0	0	0	1 0 0 0 0 0 0 0 0 0 0 0 0 0
18	0	0	0	0	0	0	3.3 18.6 1.1 0.3 14 0 1.6 0 0
19	0	0	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
20	0	0	0	0	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
21	0	0	0				
22 23 24 25 26 27 28 29 30							

Total	3.3 18.6 1.1 0.3 14.1 0 3.1

1892

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1966 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0.8 0 0.9 8.7 0.7 1.7 3.2 3.9 4.6 3.5 0.5 8.2 0 0 1.1 0 0 18. 7 9.1 19.3 1.1 0.5 9.3 2.2 0.4 0 0 3.8 0 0.3 5 1.3 4.5 4.9 2.1 9 3.4 11.9 9.1 23.7 9.6 0.7 4.9 3.9 2.6 1 13.2 2.2 0.2 10.2 0.7 6.3 1.3 7. 0.2 0.3 5.8 1.3 5.5 2.7 29.5 1.3 0.8 29.1 2.5 14.8 1.9 4.4 9.2 0.8 17.7 5.6 8.6 1.8 15.9 8.7 0.4 24.3 4.5 14.5 5.7 31.6 4.9 1.3 53.1 7 31.3 18.5 55.5 27.7 3 18.5 8.7 19.5 20 45.3 17.7 8.5 20.3 8.4 13.2 10.9 52 14.4 9.2 28.2 3.5 20.3 12.9 57.5 23.4 6.4 8.9 5.4 5.9 3.6 30.1 20.2 3.9 10.6 5.2 11.8 12.9 12.5 24.7 6.7 21.3 6.3 44.3 26.7 31.7 58.1 19 5.1 11.8 14.7 24 2.4 50.7 28.8 0.7 10 17 25.5 3.7 6.3 21.8 4.6 6.8 13.9 10.9 8.9 9.9 6.7 0.7 4.8 15.3 12 17.7 17.8 9 9.2 8.4 12.5 13.7 11.8 24.7 11.1 30.6 15.7 23.1 18.1 11.6 26.6 10.6 10.3 11.7 12 5.4 4.7 24.2 3.4 8.8 10.4 19.9 17.6 28.8 33 10.4 12.6 18.5 57 26.6 31.3 47.7 19.3 52.6 26.4 14 24.1 4.5 27.8 12.3 4.1 15.2						

Total	444.6 324.5 551.4 518.4 207.4 406.3 220.9

1893

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1966 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	16.2 47.7 20.6 27.6 50.6 29.6 34.5 18 34.7 1.2 21.3 31 13.2 30.8 9.8 10.5 0.2 12.1 6.7 9.7 14.3 23.6 6.4 10.1 11.9 7.9 9.9 8.4 50.1 10.1 9.9 22.6 9 13.2 15 42.3 24.8 15.7 33.1 22.9 10.1 15.5 19.6 23.3 10.1 22.7 24.5 7.4 15.8 23.5 15.2 2.9 14.9 15.3 12 18.1 1.1 6.5 1.3 11 6.6 4.6 7.5 2.8 4.8 0 13.2 4.1 4.1 9.8 1 4.7 1.1 2.7 3.2 5 5.6 7.3 4.3 8.5 5.4 1.9 4.9 2.3 20.2 3.5 2.3 2.1 2.4 5 1.8 4.2 1.9 0.3 4.2 0.9 7.9 1.3 8 9.2 5 20.7 4 7.8 10.2 6.2 11.6 0.4 11.8 4 4.2 6.7 6.1 10.5 0.2 13.2 2.6 7.1 3.6 0.6 0.6 0 0.1 0.3 3.3 1 18.6 1.1 3.3 1 0.3 4.9 1.6 4.4 5 5.9 10.4 3.2 3.9 7.7 7.9 4.2 4.4 1.4 1.3 7.3 1.5 4.9 2.9 2.3 8.5 0.8 1.2 2.1 0 0 0 0 0.3 0 0 1.4 0.3 1 2.5 0.7 2.3 3.5 0.7 0.9 10.3 3 0.8 0.9 3.8 1.2 1.1 3.9 7.9 2.2 2.9 10 0.3 1.3 1.9 0.2 0.7 1.2 0.6 1.2 2.1 1.7 0.1 1.4 1 0 3.2 2.5 5.3 4.4 1.7 3.3 4.2 1.3 6.8 6 2.2 5.2 36.5 4.5 8.6 11 14 2.3 7 11.3 2.4						

Total	314.3 269.5 150.2 295.3 223.5 236.1 244.1

1894

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1966 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0.4 4.1 0.9 0.2 4.2 20.7 3.2 1.5 0 3 1 0 60.4 31 28.6 26.4 23.7 31.4 10.8 36.2 14.7 1.6 16.5 9.3 0.6 13.3 2 4.7 1.1 3.1 4.8 3.7 4 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 1.2 0 1.9 7.8 1.5 12.7 7.2 2.2 2.9 1 13.4 3.5 3.6 1.3 0.8 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 1 0 0 10.3 19.7 12 8.3 12.3 10.5 1.8 17.5 15.2 0 3.9 9.4 6 1.5 50.6 7 6 5.7 3.8 1.5 3.1 2 0 0 0 0 0 0 9.8 20.4 10.3 6.7 10.8 0.7 1.6 0 0.3 0 0 0.5 0 0 0.6 7.6 0.6 0.6 6.9 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	221.1 145 67.1 91.6 96.1 58.6 51.1

1895

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1966 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.4 13.7 0 0.1 2.6 0 0 0.2 6.4 0 3.9 2.3 0 2.3 0 0.5 0 11.2 4.3 0 6.6 0 0 16.6 5.6 0 9.4 0 0 3.7 0 0 0.3 0						

Total	1.6 20.6 3.7 31.8 14.8 0.3 18.3

1896

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1967 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1897

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1967 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0.2	0	0.1	0	0	0	0.9
16	0	0	0	0	0	0	0
17	0	0	0	0	0	2	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	2.8	0	0	0	0	0	0.9
21	0.3	0	0	1.3	1	0.8	0.2
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0.8	0	0	0
16	0	0	0	0	0	0	0.8
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	1.3	0	0	0
21	2.4	0.7	0	2.9			

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	1.8	0	0	0.8
16	0	0	0	0	0	0	0
17	5.3	0	0	0	0	0	1.9
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0.3
20	0	0	0	0	0	0	3.7
21	0	2.9					

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0.4	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.3	0.4					

Total	1.3 4.6 1.2 2.4 0.7 1.7 22.4

1898

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1967 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 0 0 3.4 0.4 1.5 0.3 4.2 6.4 1.2 4.8 2.9 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 6.9 2.1 4.7 1.3 3.3 8.4 0 3.1 0 0 3.5 0.8 0.3 0.8 0 2.4 0 0 0.5 0 0.7 0.7 6.6 2.3 0.5 8 1.7 6.7 14.9 24.3 14.1 3.4 15.1 6.8 6.1 1.1 30.7 3.3 0.5 41.6 4.6 69.3 7.6 31.7 35.3 5.1 36.5 17.1 23.4 8.6 66 27.7 5.8 53.9 13.8 14.8 11.1 38.4 20.6 6.3 54.6 17.7 34.3 6.4 67.9 24.3 5 68.1 19.3 41.5 15.9 51.2 57.3 14.5 69.5 51.4 78.8 36 62.2 153.1 38.3 85.3 68.6 59.5 16.8 70.9 59.1 11 71. 27 45.5 14.1 80.8 34.6 7.5 44.6 14.8 12.7 6.9 25.5 16.7 4.6 25.6 9.7 24.6 2.9 42 13.3 3.8 46.2 10.2 50.1 15.3 63.9 60.1 11.3 71 31. 41.5 27.6 49.3 65.5 17.4 62.1 56.2 73.2 45.9 49.5 115.9 42.8 59.4 87.4 82.6 47.7 55.4 104.5 41.2 34.4 80.1						

Total	668.6 289.8 827.7 818.8 225 859.9 530.3

1899

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1967 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	21.1	48.8	18.1	34.8	22.3	25.3	54.6 62.1 50.6 48.8 77 34.8 46.6
13	75.6	48.5	65.8	44.5	75.1	26	33.7 97.5 25.7 25.4 14.5 59.1 18.3
14	14.3	45.2	9.1	9.6	9.5	15.4	10.3 11.9 24.8 12 15.9 14.4 12.5 5.3 20
15	22	10.5	15.6	13.6	29.5	30.9	16.9 28.2 10.4 11.9 13.6 22.7 17.8 10
16	24.8	7.5	6.6	2.6	11.5	6.4	4.2 15.1 6 8.3 1.9 14.6 5.3 3.1 13 7.8 7.6
17	1.9	12.7	5.4	0.8	8.8	6.2	5.3 5.6 22 6.1 5.5 11.5 6.1 3.2 3 7.4 2.4 1.
18	4.3	2.6	1.6	1.6	5.8	2.3	2.7 4.6 3.6 2.6 2.3 4.7 1.4 2 4 5.5 3 4.8 5.7
19	2.6	5.2	4	9	38.2	2.6	15.2 9.4 5.4 12.4 4.5 4.5 2.1 8.1 6.2 3.3 10.2
20	4.7	8.1	2.8	4.8	4.1	3.6	8 5.6 4.5 4.2 13.9 7.7 4.8 13.9 11.5 12.9 8.3
21	37	9.8	7	18.4	17.1	12.7	6.2 16.8 6.4 7.6 11.1 9.4 6.9 5.8 14 6 6.7
22	12.8	3.2	8.8	7.1	6.2	3.5	11.2 11.2 24.5 5.8 10.6 46.6 10.9 16.6 22.
23	17.7	10.2	32	34.8	8.8	27.5	19.7 15.5 9.2 10.1 23.6 5.6 13.7 18.3
24	12.4	7.7	8.1	14.8	4.3	7.4	12.6 17 29.2 8.8 35 10.6 10.7 23.8 11.5 2
25	9.1	37.6	11.7	8.2	17.8	6.4	10.9 4 15 4.3 5 9.2
26 27 28 29 30 31							

Total	414.7 477.4 322.5 733.9 306.9 343.2 659.8

1900

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1967 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	14.7 11.2 54.5 32.5 7 27.4 21.2 11.4 2.6 5 9.8 2 2.1 4.5 4.1 4.6 0 17.7 6.4 0 6.6 0 0 3.6 0 10.2 6.6 0.7 8.9 5 1.5 15.3 8.8 0.8 5.4 11. 4.9 1.5 25.5 5.7 3.7 13.6 14.1 17.1 17.7 16.5 5.8 23.5 28.4 29.5 15.7 30.9 73.8 16.4 22.2 50.9 0.3 0 0 1.2 0.2 0.3 5.3 0.5 0.1 1.4 2 0.4 1.7 0.9 13.6 4.3 2.9 5.4 1.7 2.8 1.2 0 0 0 0 0 0.9 0 0.2 0.2 0 0 0.4 1 0 1.3 6.1 1.3 0 25.4 7 0.2 15.2						

Total	114.9 67 119 225.4 72 93.2 155.2

1901

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1967 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0.2 0 0.1 0.6 0 0 0 0 0 0 0 0 0 0 0 6 0 1.5 0 1 0 0 0.2 0 2 0 5 0 0 1.4 1 3.3 0 5.5 0 0 1.4 0 0.3 0 0 0 0 0 0 20.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0.3 12.2 0.2 0 9.1 1.6 27.7

1902

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1968 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0 0 0 0 0 0

1903

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1968 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.5 0 0 0.2 0 0 2.2 2.8 0 2.2 1.1 0 0.8 1.5 12.8 2.5 5.5 3.5 0 41.6 0 18.1 0 0 2.3 0 0 0 0.8 0 0 0 2 0.2 1.2 0 0.1 1.1 0 2.2 45.6 3.1 0 0 0 0 9.7 11.8 41.6 11.6 13.8 0.4 3.8 0 0 0 0 0 0 0.4 8.5 0 0.3 3 0 0 14.6 7.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.8 0 0 0.7 0 0 5 16.5 0 0 1.8 0 4.2 3 9.8 0 2.4 1.9 0 2.1 0.8 3.3 0.9 4.6 2 0 34.1						

Total	83 103.2 45 26.7 31.4 0.4 90.8

1904

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1998 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0.3 0.3 0 1 0 0 0 0 0.2 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
13	0 0 0.5 0.7 0 11.8 0 1.2 0 0 0 0 0 0 1 0 0 1.5 7.8 0 0.7 2.1 0 0 25.5						
14	18 0 1.1 3.3 0 1.1 17.1 6.6 30.2 0.7 1.8 0 3.5 11.8 9.1 0.2 1.4 2.7 (						
15	4 68.3 34.1 106 97.9 3 119.4 38.4 29.7 9.1 42.4 27.1 3 31.9 15.4						
16	29.5 8.7 12.2 30.1 3.2 30.8 9.9 61.4 13.5 39 79.6 5 91.2 38.6 49.7						
17	16.5 49.3 23 11.8 111.5 14.7 40.6 14.9 24 26.6 9.5 11.5 14 37.5						
18	27.6 28.5 54.7 15.5 78.7 21.1 13.9 10.2 13.4 7.2 2.9 13.7 3.3 21						
19	14.9 28.4 20.8 10 17.5 54.3 39.5 28.2 21.1 81.4 18.2 16.6 81.7						
20	161.6 67.8 81.4 100.8 33.5 69 64.8 147.5 89.2 75.1 109 60.9 145						
21	71.5 78 37.1 53.1 69.6 19.1 55 42.6 49.9 25.5 7.9 47.8 4 100.1						
22	28.5 25.1 8.6 11.4 17 8.9 9.6 11.5 28.1 50.5 16 23.5 24.5 24.9 17.						
23	41.9 13.5 39.4 20 7.5 20.9 14.3 100.4 3.8 11.4 3.3 1.9 9.8 2.7 47						
24	6.2 7 11.2 3.7 12.4 3.6						
25 26 27 28 29 30							

Total	1127.2 521.9 709.7 854.5 259.2 969.9 557.1

1905

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1968 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	45.9 46.4 23.8 51.9 43.5 27.4 47.3 16.8 32.7 14.4 46.7 28.5 7.2 30.6 10.7 18.4 3.4 10.8 14.8 8.4 14 18.2 9.7 3.3 1.5 14.1 3.7 7.5 7.5 9.9 5.1 16.4 20.9 6.7 17.3 15.2 45.5 7.7 11.5 48 9.5 30.2 9.4 35.9 5.7 29.7 42.3 11 50.2 15.8 27.2 9.2 19 38.2 12.2 42.8 21.2 20.9 9.3 28.5 24.5 10.8 20 13 17.3 7 21.7 20.4 7.4 16 11.9 16.1 8. 26.3 19.2 5.6 18.7 38.4 18 12.1 33.9 22.8 12.2 24.8 18.5 11.2 5 6. 16.2 6.2 12.2 10.4 16.9 12.8 29.2 24.7 7.1 18.4 7.5 18.1 0.5 4.4 28.9 5.3 7 6.1 29 2.5 33.4 36 10.9 27.6 5.9 17.7 1.5 12.7 23.9 8.6 27.4 4.6 6.8 2.6 4.8 13.8 4.3 9.1 3.1 6.4 0 4.2 12.6 4.1 6.3 4.4 6.1 0.1 5.1 11.6 1.4 7.2 3.8 8.8 5.2 8.7 12.3 3.4 7.5 10.9 20 9.4 11.3 18.9 2.9 5.7 5.1 4.7 0 1.4 8.1 5.1 8.9 5.1 17.2 6.8 17.8 10 3.8 9.7 0.4 4.4 0.2 7 6.6 8 5.4 0.1 3.6 0.3 4.1 3.7 5.2 3.1 0 0.2 0.4 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 4.1 0 0 0 0.5 0 0 0.8 0 0 0.2 3.5 3.9 0 0.6 0						

Total	309.9 469.3 161.1 452.6 564.5 203.9 475.7

1906

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1968 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	25.2	15.9	9.1	70.6	14.5	14.7	19.4
15	80.4	56.5	107.3	157.2	40.5	58.2	37
16	13.8	2.7	4.1	4.5	1.3	0	0.9
17	5.4	0	14.6	3.8	0.7	6.6	55.2
18	1	3.5	1.8	3.3	5.2	0	15.6
19	1.5	0	0	0.9	7.7	7	0
20	8.6	0	6.8	3.5	0	0.7	0
21	0.7	0.8	0	0.2	1	0	2
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	46	7.6					
15	60.8	12.9	60.8	17.1	2.7	25	2.5
16	4.5	0	0	0	0	2.2	2.3
17	21.7	5.1	1.9	2.3	4.		
18	6.7	0.3	5.1	8.9	0	0	0
19	36.1	13.6	42.2	15.2	0.9	3	
20	29.9	0	15.9	23.6	0.7	15.5	
21	0	0	0	0	0	0	0.1
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0

Total	331.4 201 275.1 362.8 131.4 212.1 147

1907

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1968 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1908

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1969 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1909

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1968 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	14	17.9	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	0.6 0.9 5.6 31.9 27.1 17 41.5

1910

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1969 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	6.9 0 12.8 2.4 0 5.7 0.5 3.5 10.3 26.6 6 0.2 14 5.7 8.5 2.2 8.5 5.9 2.7 13.2 2.4 12.2 6.7 17.9 35.8 5.3 10.9 9.3 14.6 8.9 18.9 13.7 6.3 18.6 9.8 37.8 15.1 49.8 41.8 5.6 63.8 30.9 4.7 3 1.8 14.2 2.4 15.2 8.9 9.6 4.9 6.1 8 2.3 6.4 3.2 5.1 0.7 5 22.9 3 8.2 5.9 18.5 8.4 37.7 11.6 2.7 9.4 4.2 32.7 14.6 50.2 33.3 3.6 53.1 12.4 9 1.2 6.6 11.7 0 0.5 3.8 10.5 7.7 2.1 26 1.9 3.6 7.8 48.8 11.1 41.6 38.8 2.7 114.9 10.9 12 3.4 12.2 9.3 1.8 19.6 3.1 6 5.2 6.9 20.7 3.2 10.3 6.8 5.8 1 2.6 5 4.5 4 2.7 10.9 6.1 9.4 15.7 8.1 4.1 13.4 64.6 26.7 30.7 29.2 13.5 23.1 9.1 70.1 48.2 41.8 68.8 29.2 47.7 26.1 55 24.5 13.5 44. 15.4 59.2 36.6 28.6 35 4.7 28.3 24.7 5.7 20.4 4.1 6.3 10 6.5 11.6 6.6 16.6 57.4 10.1 48.4 22.1 8.7 33.4 13.6 2.3 1.1 15.1 4.8 2.6 41 2.9 3 0.7 11.8 3 1.9 5.5 3 52.5 13.8 155.6 21.5 7.6 43 5.6 58.9 23. 40.4 22 12.4 34.7 6.8 93.9 43.9 159.8 87.6 27.8 136.4 41.4 54.3 34.2 35 20.4 17.7 61.5 10.4						

Total	801.8 378.7 883.5 681.4 229.4 873.5 334.2

1911

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1969 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	60.4	109.9	20.9	90.5	99.2	35.1	72.8
13	68.4	24.2	46	9.2	17	40.2	27.9
14	39.6	47.6	8.5	41.5	42.1	15.7	39.9
15	13.7	25.3	6.5	21	33.4	11.3	32.3
16	33.8	63.1	33.9	132.1	54.6	57.4	76.4
17	28.9	26.9	24	8.4	18.4	18.6	43
18	4.7	3.3	5.1	4.5	8.1	2.1	8.2
19	8.7	12.6	4.7	2.6	2.3	6.8	0.4
20	5.1	2.5	1.6	9.1	0	0	0.5
21	1.9	0.6	1.3	60.3	1.5	1.2	15.9
22	11.4	2.3	37.7	0.2	8.9	12.1	10.7
23	10.5	18.1	3	2.9	0.6	3.8	8.1
24	1.3	0	2	2	0	0.9	0
25	43.4	15.5	35.7				
26 27 28 29 30 31							

Total	688.8 709.2 217.4 836.6 587.1 405.5 590.7

1912

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1969 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0.2 0.8 0.5 0 0.2 0 0 0.4 1.9 0 0.2 0.5 0 0 0 0 0 0 0 0 0 0 0 0.4 0						
15	3.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.8 0 0 0.2 1.2 0 0 11 12.7 0 9.4 8.7						
16	1.8 18.6 1.1 1.9 20.5 1.1 26.4 8.9 0.5 6.4 2.2 2.1 3.8 15.2 6.1 0 2.						
17	0 0 0 0.1 0 0 1.1 1 0.6 0.9 0.8 0 0 0 1.3 0 0 6.4 0 0 0 0 0 0.7 0 0 0						
18	0 0 0 0 0 0 0 1.5 0.2 0 0.9 0 10.7 7.3 2.8 3.6 3.1 1.8 0 18.2 9.8 2.6						
19	8.9 8.2 22.1 1.2 13.6 8.6 22.1 14.8 4.4 13.3 3.2 33.8 18.4 7.3 23.3						
20	7.4 13.2 10.2 16.9 8.6 0.1 1.6 6.9 0.3 3.5 9.6 0 0 0 0 0 0 13.7 0 1.						
21	0 0 1 0 0 0 0 0 1.2 0 0 0 1.6 0 0 2.6 0 0 13.9 6.6 0.9 15.8 10 2.5						
22	13.2 8.5 21.6 2.1 2.2 12.1 2.3 14.3 0 4.1 1.2 0.5 0 0.7 4 0 0 0 0 0						
23	0 0 0 1.3 0 0 0.8 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	174.4 113.1 50.4 104.3 73 107.8 69.6

1913

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1969 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 12 12.5 9.9 0 2.3 5.5 2.3 1.3 0 0 0 0 0 0 0 0 0 0.4 0 0 0.2 0						

Total	12.5 9.9 0.4 2.3 5.5 2.5 13.3

1914

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1970 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0.2 0.8 0 1.7 0 0 0 0 0 0 0						

Total	0.3 0 0 0.2 0.8 0 1.7

1915

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1970 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0.6 0.4 0 4 0 0 0 0 0 0 0 0 0 0 0.7 0.5 0 5.1 0 0 0 0 0 0 5.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0.8 0 0 0 0 12.6 (7.5 0 0 0 0 0 0 0 0 0 0 1.1 0.8 0 7.8 0 2.1 0 0.7 0.5 0 6.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 1 0.7 0 6.9 0 0 0 0 0 0 0 0 0 0 0 3.8 0 0.2 0 0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.9 0 0 0 0 0.7 0.5 0 4.9 0 0.8 0 0 0 0 1 0.2 0 0 0.4 0.3 0 3 0 14.8 0 9.8 5. 0 2.5 2.6 5.2 2.5 20.6 5.8 0 7.1 2.9 0.5 0 8.6 3.1 0 15.3 0 0 0.1 0 0 0 0 0.3 0 0 0.4 0.3 0 3						

Total	6.1 30.4 2.6 44.6 34.4 0 79.1

1916

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1970 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	22.3	3.3	56.2	20	2.1	26.5	5.9
12	11.4	30.5	71.3	6.5	31.1	18	68.8
13	32.3	67	58.8	5.8	38.9	15.1	127.7
14	18.1	70.3	47.1	4.7	72.6	19.4	22.9
15	4.3	11.9	4.2	0.6	16.5	2.1	6.7
16	12.3	33	4.7	29.3	30.7	79.6	54.5
17	21.6	72	28.6	51.8	52.3	100	35.7
18	64.8	23.1	37.1	12.7	77.5	26	84.5
19	66.9	19	27.5	23.3	12.9	34.6	24.5
20	129.2	9.7	31.7	19.8	2.1	11.1	7.2
21	26.5	12.8	1.4	13.4	4.5	27	12.1
22	13.9	3.5	17.4	5	51.1	25.7	3.8
23	42.5	12.4	30.8	23	74.8	7.6	92.2
24	16.6	5.1	33.8	5.1	24	1.1	0.8
25	0.8	24.9	12.2	1.5	3.3	3.6	3.9
26							
27							
28							
29							
30							

	29.4	3.1	3.1	3.5	0.8	1.3	3.4
	11.8	26.6	3.5	18.1	6.1	45.6	17.1
	25.2	11.3	13.8	15.7	56.5	16.4	43.8
	92.2	42.2	2.3	60.3	13.6	90.2	10.3
	9.7	0	4.1	3.4	133.4	12.2	1.2
	12.2	1.5	3.3	3.6	3.9	2.8	

Total	1959.7 566.9 828.5 974.4 223.9 1028.9 489.8

1917

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1970 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	10.6	4.4	2.4	8.8	4.6	2.8	10.1 11.8 17.6 15.7 24.3 16.3 14.7 19.8
12	19.1	21.3	3.4	21.1	21.1	16.3	29.9 21 24.4 1.2 8.5 22.2 25.6 20.4
13	35.6	41	8.2	25.5	30	14.6	28.3 81 32.9 43.5 59.4 19.3 63 36.7 85.3
14	25.1	63.8	30.6	8.2	33.7	13	156.1 69.4 137.5 54.2 14.4 127.7 22.6
15	200.9	88.8	70.3	109.3	43.4	114.8	61.9 167.2 76.1 184.8 114.1 47.
16	155.1	50.3	73	41.6	148.2	49.9	13 100.7 19 71.4 32.9 51.4 29.2
17	13.8	54.9	21.2	46.4	46.7	20.6	27.7 18 29.3 18.1 123.7 72.5 54.3
18	117.6	53.3	64.8	55.5	59.2	39.7	26 69.1 28.9 29.9 52.9 89.4 45.5
19	40.1	39.9	21.3	36.2	21.5	74.9	55.7 42.9 69.2 43.7 39.1 37.1 56.1
20	56.7	16.6	39.4	48.8	12.8	44	53.7 48.9 13.6 40 46.6 33.2 58.3 30.2
21	36.7	29.5	61.9	49	60	61.3	31.8 53 19 32.9 39.1 41 48.3 38.5 84.7
22	39.7	85.3	80.4	49.1	74.9	23.5	23.6 3.2 36.9 31.8 11.1 40.7 8.3 3.8
23	3.6	28.3	5.5	15	18.9	2.9	0.8 1.4 1.9 5.3 3.1 7.6 7 5 2 22.7 4.1 3.9
24	12.5	8.4	3.1	9.5	14.9	4.2	20.1 11.7 9.5 3.5 2.5 13.8 6.6 8.5 13.4
25	10.2	2.7	6.4	8.7	3.5	23.9	16.1 8.9 6.8 2.9 5.2 3.3 1.7 6.9 12.4 6.8
26	15.8	15.2	3	13.1	11.7		
27							
28							
29							
30							
31							

Total	1628 1071.7 1080 1265.5 750.4 1219.7 944.6

1918

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1970 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0 0.8 0 0.4 1.2 0 2.8 0.1 11.2 1 2.1 10.3 0.1 14 1.6 2.5 3.5 17.8 2						
15	11.4 9.4 0 3.6 0 2.7 2 21.9 2.6 1.1 16.4 6.6 6.5 22.5 5.6 7.5 0 2.6						
16	0.5 0.8 3.4 8.4 2.3 2.3 11.1 0 8.2 14.1 0.6 8.9 7.5 39.9 0.2 11.7 21						
17	12.1 7.8 0.1 3.5 4.9 20.7 8.6 17.5 15.3 0 6.9 0.6 1 6.9 2.2 0.4 5.6						
18	9.7 18.7 18.3 9.2 33.9 13 5.5 6.7 0.4 8.4 10.1 0.1 2.2 4.4 9 0 3.5 3						
19	1 2.3 8.2 5.9 0.7 18.9 6.4 7.6 9.6 9 8.2 0.6 0.7 5.8 0 0 0 0 0 0 0 0 (						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0.3 1.8 0 0						
21	0.5 17.2 0 2.9 2.8 0.9 7.9 0.5 0.3 1.7 2.5 5.4 1.2 13 1.5 0.6 2.8 0.1						
22	0.5 0.2 0.7 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23	0 0 0.1 0.6 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	51.3 149.1 40 143.5 129.4 141.4 102.6

1919

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year 1970 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1920

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1971 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1921

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year -1971 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	3	3.5
16	0	0	0	0	0	0	0
17	1.4	0.6	0	0.2	0	0	0.9
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.4	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0.7	0.9	0
16	0	0	0	0	0	0	0
17	0.6	0	0.2	0	0	0.9	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0.2	0.3	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0.5	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.7	0	0.6	0.7	0	0	0
21	8.4	0	1.6	7.3	0	0	

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0.8
17	0.5	0	0	0.3	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0.3
20	0	0	0	0	0	0	0
21							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0.2	0.4	0	0	0	0	0
21							

Total	1.8 11.1 2.2 3.3 7.6 4.1 4.7

1922

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1971 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	15.6	5.7	33.1	8.6	12.5	30.7	5.7 23.8 19.7 87.2 26.3 15.5 112.3 21
12	28.6	34.5	62.2	35.3	19.6	65.5	41.1 22.3 36.2 21.1 28.9 48.9 48.6
13	40.7	40.9	52.7	76.9	50.5	30.2	118.9 61.6 20.5 38.5 40.3 29.5 13.5
14	36.5	38	3.8	6.8	1.9	5.5	6.2 4.6 12.3 8.1 2.7 5.6 12.9 3.2 26.6 21.9
15	3.7	2.7	10.3	8.9	2.5	10	10.5 2.2 3.9 0 2.8 2.4 4 3.9 2.8 3.1 0.1 3.1
16	4.5	3.3	5.7	6.8	4.4	2.5	8 4.2 2.5 14.4 12.6 1.2 15 14.2 1.5 6.9 20.2
17	9.1	4.5	1.7	19.2	0.6	8.7	25.9 9.5 3.1 1.7 6.1 0.8 1.6 7.9 3.4 1.2 1.6
18	4.8	0.5	13.1	6.3	1.7	1.9	0.2 2.2 1.8 24.4 2.9 20.7 4.8 98.6 16.6 1.2
19	59.1	4.1	27.3	0.9	79.8	13.5	2.5 60 2.2 54.8 12.2 193.6 35.6 18.9
20	83.8	4.9	61.2	23.8	170.7	45.3	38.2 103.8 16.1 55.8 47.1 103.5 49
21	57.8	77.6	40.6	64.9	65.6	44.7	68.6 90.2 85 63.7 69.2 60.2 35.5
22	56.7	70.9	21	54.5	38.2	33.4	5.1 36.4 27.3 8.4 43.5 29.7 26.3 8 30
23	26.5	6.7	31.1	18.1	19.2	1.4	13.8 25.5 13.5 12.6 24.8 21 5.9 28 24
24	25.5	32.9	12	13.3	0.9	19.2	11.8 2.6 22.4 20.1 10 7 15.7 9.3 14.2
25	17.5						
26							
27							
28							
29							
30							

Total	712.2 560.6 1116.1 696.2 573.3 1079.4 686.1

1923

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1971 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	10.7 5.2 1 7.1 6.9 3.7 6.3 5.4 1.4 0.1 5.9 2.9 6.3 6.7 4.3 1.1 1.5 2.(						
13	2.1 1.2 2 2.2 1.3 0.5 2.3 2.5 1.7 3 15.3 8.2 13.8 11.6 6.2 27.8 11						
14	10.9 4.7 8.9 7.2 5.6 3.6 6.1 8.9 3.6 0.3 5 4.7 3.7 5.9 13 7.5 12.7 9						
15	11.2 5.8 8.7 26.6 24.1 9.7 22.7 24.9 15.1 20.8 25.6 21.5 7.4 21.5						
16	16.8 9.5 21.5 16 8.9 14.1 15.5 8.7 12.1 14.9 8.6 3.4 4.8 6 3.5 6.6						
17	6.8 10 6 12.9 8.8 5.5 7.3 8.1 21.7 16.2 28.3 20.4 11.9 39.4 18 12.9						
18	4.9 38.8 12.4 6.3 40.9 8.9 17.6 14.9 23.8 16.2 14.9 6.8 8.8 5.8 2.8						
19	8 6.8 2.4 7.2 7 2.3 0.6 5.9 3.3 0.6 5.9 3.7 4.4 1.8 0 3.7 3.3 0.9 2.9						
20	0.1 0 0 0 0.2 0.4 0 0.1 1.1 0.4 0 1.1 2.5 1.7 0.7 1 1.2 1 2.7 10.4 3.(						
21	3.1 0.8 2.3 2.7 3.7 15.1 3.5 6.9 2.9 9.8 5 6.5 15 2.9 2.5 1.5 0.8 2.4						
22	0.8 4 2.9 9.7 2.6 8.1 5.6 4 9.8 4.4 14.4 15.7 3.9 7.9 14.5 14.1 6.4						
23	28.1 20.5 23.7 28.3 21.6 19.6 29.7 23.7 23.1 4.7 19.9 27.1 19.6						
24	21.2 36.5 44.9 37.3 34.5 45.9 14.2 30.4 38.3 38.4 25.9 36.2 40.5						
25	35.3 35.9						
26 27 28 29 30 31							

Total	386.3 290.6 310.6 332.1 309.5 365.5 313.7

1924

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1971 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0.6 1.3 4.7 3.5 2.8 3 0.2 1.7 0 0 0 0 0.5 0.7 3.1 0 0 0 0 0.9 0.6 2.3 0 0 0 7.9 0.5 0 0 0 0 0 3.4 0.4 0 0 2 0 1.6 1.2 0 1.2 0.4 1 4.7 0.7 4 1.5 10 1.5 3.3 31.7 0 11.1 4.2 2.2 1.2 0 0 3.2 0 0 0 3.5 0 0 0.4 0 0 3.8 0 0 4.8 0 0 0 6.9 0 1.1 11.3 0 3.3 0 0 0 0 0 1.3 0 0 0 0 0 0 2. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0.3 10.6 0 7.4 0. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	21.7 18.8 11.3 51.6 25.1 39.4 16.2

1925

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1971 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1926

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1972 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0.2 0 0 0

1927

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1972 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 3.1 2.2 1.7						
19	1.1 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0.1 0 1.3 10.2 0 0 0 0.2 0 0 0 0 9.3 0 0 0.2 0.1 0 0 0.9 0 0						
21	0 0 0 3.9 0 0.2 0 0 0 0 30.6						
22 23 24 25 26 27 28 29 30							

Total	0.9 1.2 3.3 3.6 11.9 1.1 45

1928

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1972 : Month - June							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 1.8 0 0 0 0 0.7 2.8 0 0 0 0 0 1.6 5.3 0.2 0 0 0.1 0 2.4 7.6 1 0.2 0.9 0.2 0 10.3 12.1 6.5 11.4 7.5 7.4 10.8 25.7 13.8 38.4 15.9 7.7 18.9 14 34.5 12 101.3 22.2 4 89.2 12.6 12.7 14.1 21.3 8.3 4.6 21.2 5.5 27.8 52 49 16.1 14.6 98.9 13.2 68.6 78.6 70.5 43.7 30.6 67.3 35 48.1 88 77.2 40.3 33.8 63 41.6 98.8 65.2 156.4 68.4 51.7 116.8 47.2 56 48.2 9 48.5 44 115.1 43.5 46.9 54.5 25.7 41.2 38.5 27.5 47.6 45.7 64 53. 46 35.5 76.2 50.6 63.9 105.5 71.2 59.9 71.7 103.3 52.6						

Total	544.1 626.2 771.4 422.1 345.1 805.1 374.2

1929

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1972 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	7.3	13.7	7.2	6.2	7.2	6.5	4.8
13	3	3.7	3.5	2.3	4.2	3.4	3.1
14	5.1	8.5	2.9	5.8	3.6	2.2	6.4
15	13.5	10.5	2.4	17	5.5	6.3	2.4
16	8.1	16.5	8.5	25.7	12.8	5	37.3
17	13.7	9.7	25.2	9.1	4.5	18.2	6.9
18	14.5	10.2	8	13.7	8.9	25.1	31.1
19	16.1	10.7	13.2	18.7	11.6	13.7	6.8
20	33.3	16.7	23.5	40.8	30.9	35.4	3.8
21	13.6	11.8	9.3	11.6	11	25.7	12.9
22	3.5	8.1	12.3	3.2	7.5	26.4	13.5
23	23.9	41.7	13.8	79.3	52.8	11.6	7
24	3.5	3.1	6.7	3.2	6.8	3.9	11.7
25	0.5	0.8	2.5	0.6	0.9	5.1	0.6
26							
27							
28							
29							
30							
31							

4.8	3.1	4.5	2.8
3.1	3.4	0.9	6.5
6.4	9.2	11	17.9
2.4	6.3	2.9	5.9
37.3	13.4	19.4	18.7
7.8	7.2	3.6	8.7
31.1	31.9	16.7	21
6.8	11	12.6	11.6
3.8	28.4	23.5	11.5
12.9	24.7	13.3	10.3
13.5	5.3	17.1	16.3
7	1.2	15.8	5.9
3.9	11.7	6	3.5
0.6	0.2	0	0.1

7.2	6.5	4.8	3.1	4.9	0.8	4.3	3.1	12.1	5.2	3.1	4.5	2.8
3.5	2.3	4.2	3.4	3.1	3.4	0.9	6.5	4.2	6.2	4.7	3.2	7	4.1	23.2	8.7
2.9	5.8	3.6	2.2	6.4	9.2	11	17.9	13.5	4.8	13.4	14.8	7.7	11	2.
2.4	17	5.5	6.3	2.4	6.3	2.9	5.9	7.6	8.2	7.7	9.1	7	5.1	21.7
8.5	25.7	12.8	5	37.3	13.4	19.4	18.7	29	15.8	11.7	44.3	12.
25.2	9.1	4.5	18.2	6.9	7.8	7.2	3.6	8.7	5.5	2.6	9.9	12.2	16.3
8	13.7	8.9	25.1	31.1	31.9	16.7	21	35.9	7.5	18.5	22	6.4
13.2	18.7	11.6	13.7	6.8	11	12.6	11.6	14	37.4	20.6	20.7
23.5	40.8	30.9	35.4	3.8	28.4	23.5	11.5	27.7	21.9	17.1
9.3	11.6	11	25.7	12.9	24.7	13.3	10.3	12.4	7.7	12.1	15.6
12.3	3.2	7.5	26.4	13.5	5.3	17.1	16.3	32.4	20.5	28.7	14.8
13.8	79.3	52.8	11.6	7	1.2	15.8	5.9	15.2	20.4	5.7	3.9	4.2
6.7	3.2	6.8	3.9	11.7	6	3.5	6.6	4.3	2.2	1.2	2.8	3	1.3	4.2	2.9
2.5	0.6	0.9	5.1	0.6	0.2	0	0.1	0	0	1.1	0.4

Total	394.5 349.6 313 353 241.8 487 371.1

1930

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1972 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.5 0 0 1.5 1.5 7.3 3.1 4.3 15.7 0.4 1.8 0.3 3.9 5.2 0.5 1.2 0 0.5 1. 0 0.5 2 0.7 0 3.2 2 0 4.4 2.2 11.5 0 0 5.8 0 0 12 23 1.1 10.7 13.2 0 8.3 4.7 12.2 2.4 4.8 12.5 0.9 0 1.8 6 0 0.7 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 3 0 1.2 0 0 1.6 0.5 2.1 0 0 0 0 0 1.2 4.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 2.1 0 0 0 0 0 0.5 3 0 0 0.3 0.9 0 11.2 17.9 8.1 8 14.2 1.7 1. 0.4 1.5 0 0 0 0 0 2.2 0.9 1.9 0.8 1.4 2.1 0 4.8 5.5 3.7 7.4 6.8 6.9 9 3.4 5.6 0.8 4 8.9 8 3.4						

Total	54.4 116.6 18.4 44.6 69.7 31.8 37.4

1931

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1972 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.4 0						

Total	0 0 0 0 0 0 3.4

1932

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1973 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1933

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1973 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	3.4	0
16	1.9	0	0	0	0	1.5	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	4.1	0
19	0	0.3	0	0	0	0.3	0
20	0	0	1.5	0	0	0	0
21	0	0	0				
22 23 24 25 26 27 28 29 30							

Total	0 0 0 0 8.3 0 5.5

1934

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1973 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 16.2 0 0 2.5 0 0 0 4.3 0 9.4 4.8 2 16.1 9.3 4.9 5.9 4.7 10.8 16.7 6.8 4 5.9 9.4 18.4 8 10.8 26.5 7.1 2.4 12.4 12.4 4.6 11.4 3.9 3.6 24.6 3.9 16.5 6.9 0 3.9 38.7 35.1 14.9 17.7 5.3 20.3 24.9 22.1 24. 45.2 31.2 9.1 47.4 17.1 48.9 27.8 88.5 59.8 14.5 39.9 21.3 64.3 31.2 26.8 50.8 11.1 26.7 27.6 84.1 59.3 81.7 88.1 13.3 43.8 25.5 133 66.5 192.4 114.2 13.8 115.8 12.8 55.4 71.8 32.4 106.9 14 52. 32.3 36.4 29.5 11.2 42 12.4 13.8 23.1 38 67.1 5.8 22.8 72.8 8 20.9 33.2 122.4 13 15.6 142.9 15.4 32.2 47.4 56.3 48 123.4 72.3 27.3 79.9 25.8 17.6 2.3 4.8 12.5 7.2 6 9.7 15.2 3 12.9 12.5 2.8 7.4 6.6 10.4 3.8 6.6 5 4.2 8.3 20 4.4 8.9 20.7 0.2 8 5.5 1.4 1.9 3.5 0.7 0 2 2 1.1 0 1 1.7 0 2.2 2.1 4.3 8 2.3 43.1 7 7.9 9 6.6 5 13.8 8.7 0.3 14 2.6 19.2 12 46.4 19.8 2.3 69.1 1.3 27.3 14.9 101.1 57.9 3.6 64.4 14.1 28 5.2 28.8 8.1 2.3 33.5 2.2 9.1 3.8 9.9 8.6 2.9 13.9 9.4 35.6 5.3 14 5.5 2.2 5.2 0.7						

Total	820.2 753.7 830.3 933 469.9 687 445.4

1935

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1973 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	18	5.6	15	24.7	1.9	30.7	12.6
12	35.7	16.6	1.9	34.2	6	7.2	4.8
13	4.1	18.4	0.8	44.3	21.4	35.7	21.7
14	65.9	19.3	78.1	30.2	36.1	56.1	14.6
15	17.3	97	27.9	39.2	25.7	36.1	14.5
16	3.9	60.9	9.1	79.7	34.6	81.1	43.9
17	55.8	35.4	115.3	69.7	6.3	33.7	51.3
18	33.3	63.2	46.3	66.6	127.3	17.7	46.3
19	43.4	7.6	16.2	7	26.5	3.1	15.3
20	15.7	13.9	32.8	36.7	9.1	34	22.3
21	15.6	24	34.3	4.2	29.8	19.9	6.9
22	22.6	21.8	42	23.3	30.5	23.5	18.3
23	11.1	9.7	17.2	7	16.3	15.3	7.5
24	14.3	32.7	9	31.1	16.7	17.5	19.6
25	13.1	24.9	9.8	21.7	14.9	9.6	12.3
26							
27							
28							
29							
30							
31							

Total	1219.2 1043.8 864.5 1059.2 563.2 931.2 515

1936

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1973 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	3 1 6.7 1.4 1.5 9.5 3.7 6.6 3.9 19.2 38.6 1 16.4 4.2 14.4 4.1 32.9 8.6 0.9 8.7 3.7 11.5 4 19.6 12.3 1.4 8.9 2 3.9 3 2.5 4.7 2.5 9.5 1.6 0.4 0.8 40.1 0 3.9 13.5 0.5 0 0.1 0 0.3 0.7 1.8 4 0 0.1 0 14.2 3.3 8 5.3 3.2 41.2 66.9 18.6 36.8 24.3 0.6 0.3 0 0 0.9 0 0 6.8 6.9 1.1 3.8 0.7 0.4 0.3 0.2 1.6 0 0.1 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0.1 0 3.4 0.6 2.4 0 0.5 0 0.2 22.4 0.2 5.5 10 6.9 0 3.7 0 0 0.3 2.5 0 0 0 0 0 0 0.5 3.4 0 0.2 1.9 0 0 0.5 3.2 0 0.2 5 2.2 5.7 3 4 5.1 3 7.5 3 6.9 4.6 4.7 10.8 29.9 4.4 6.2 9.4 15.1 17.2 0 1.3 15.5 2.5 1.8 1.6 3.2 8.5 0.3 5.2 2.2 2.1 13 11.2 14.8 0.3 2 10.4 0 0.8 0.2 12.3 1.7 0.7 16.4 0.6 2.7 0.4 1 0.3 6.6 1.3 2 0.7 0.7 2.1 6.6 12.7 2 2.6 1.9 0.6 3.3 7.7 3.2 3.2 3.4 3.3 2.7 4.4 18.6 0 2.4 1.3						

Total	121 90.9 186.6 250.5 132.9 151.4 107.7

1937

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1973 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 4.4 0 0 5.8 0						

Total	0 0 4.4 0 0 5.8 0

1938

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1974 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1939

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1974 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0.9	0.2	0
16	0	0	0	0	0.7	0	0
17	1.8	0	0	0	3.1	6.4	0
18	0	6.2	0	2.6	0	0	0
19	0	0	0	0	0	0	0
20	10.7	0	0	0	0	0	0
21	0	0.6	0	0.4	0.7	0	0
22 23 24 25 26 27 28 29 30							

Total	8.4 17.9 2.9 9.1 20.3 4.5 50.6

1940

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1974 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	12.8	17.2	12.4	8.2	2.7	4.6	4.7
13	14.5	7.7	34.9	20	5	41.9	0
14	13.9	0	5.5	2.1	0	0	2
15	6.6	22.3	0	0.8	0	1.1	0.1
16	1.5	0	0	0	0	0	0
17	13.8	58.8	9.9	2.9	53.1	2.6	9.7
18	38.9	10.8	4.6	12.8	2.8	19.9	44.3
19	56.7	5.6	7.1	33.8	3.1	24.8	18.8
20	18.7	4	60	21	8.2	2.3	46
21	6.2	27.1	23.6	147.1	17.9	8.1	71.1
22	14.4	27.4	27.1	54.7	47.7	31	34.4
23	9.9	5.4	24.1	5.9	1.9	28.1	6.1
24	36.1	38.6	32.9	11.1	28.4	24.1	
25							
26							
27							
28							
29							
30							

Total	420.4 429.2 836.6 394.9 187.5 727 346.3

1941

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1974 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	81 49.7 55.4 100.1 28.5 6.4 19.4 100.4 51 33.3 90.6 25.8 76.9 48 89.8 66.1 40.5 14.8 22.7 50.7 7.6 73 22.8 41.3 60.5 10.5 53.4 18. 64 21.8 40.3 89.3 10.4 48 18.2 45.5 29.1 1.2 21.9 20.9 12.4 29.1 66.6 34.1 3 11.5 18.6 8.2 14.8 68.8 83.5 32.7 73.9 51.9 31.7 54.7 63.5 98.5 52.7 128.3 47.3 76 35.8 128.4 89.7 59.1 29.7 51.3 72.3 48.9 96.8 44.8 42.5 114.3 32.1 44.9 29.4 68.7 32.6 12.2 50 16.1 10.8 21.2 4.4 23 7 29.9 23 38.7 33.4 37.6 30.6 13.5 23.7 30.9 14. 21.6 29.3 26.6 10.7 31 23.7 21.3 24.8 27.8 37.3 14 33.7 23.9 22.2 33 24.7 54.2 4.7 13.1 28.3 5.2 25.1 23.4 34.5 6.2 27 20.2 19.9 21 22.6 30 8.2 33.6 20 27.4 25.5 19.5 17.4 6.8 19.8 10.5 10.9 15.7 1 26.1 16 43.7 19.6 23.4 20.9 15.1 6.7 0.9 9.7 4.8 2.7 4.3 14.7 5.4 4.3 3.6 5.1 3.6 2.9 15.4 7.8 3.7 4.6 6.6 4.3 2.7 6 7.9 1.8 4.2 3 0.8 4.4 7.2 8.8 0.6 2.2 3.6 0.9 5.3 8.6 13.1 3.5 6.2 4 6.2 8.5 6.4 10 1.6 8 4.2 0.4 14.6 8.2 7 4.6 11.6 5.8 4.4 8.9 11.1 5.4 0 8.1 2.5 0.9 3.4 14.1 5 5.3 1.2 2.3 3 1.7						

Total	1259.6 980.5 527.6 1099.8 578.1 702 624.5

1942

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1974 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	12.9	2.2	10.1	27.2	2	7.2	4.7
14	1.3	0	2	5.2	4.2	0	0.2
15	24.2	7.7	5.5	11.5	9.4	8.6	17.9
16	0.2	28.9	9.2	2.4	4.9	1.7	3.3
17	1.8	0	8.5	3.5	13.1	2.2	1.6
18	21.6	0	0	6.7	0	0	0.5
19	11.2	6.4	12	4.4	31.3	16.5	4
20	20.7	43.9	1.4	2.8	11.3	11.8	1.2
21	7.5	14.8	29.7	25.1	8.7	5.8	24
22	2.9	1.4	6.4	5	3.1	2.7	18.4
23	10.5	0	0.9	5.2	0	7	0
24	0	0	0	0	0	0	0
25							
26							
27							
28							
29							
30							
31							

3	4	2.4	2.6	8.2	0	0.8	0	0.5	0.9	0	3.8	1.5
4	5	1.9	0.8	5.9	1.6	0	0	0	0	0	0	0
5	6	0	0	0.6	0	0	0.					
6	7	0	0	0	0	0	0	0				
7	8											
8	9											
9	10											
10	11											
11	12											
12	13											
13	14											
14	15											
15	16											
16	17											
17	18											
18	19											
19	20											
20	21											
21	22											
22	23											
23	24											
24	25											
25	26											
26	27											
27	28											
28	29											
29	30											
30	31											

Total	530.9 216.4 322.4 272.4 129.7 123.2 118

1943

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1974 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1944

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1975 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1945

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1975 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.4	14.1	0.2	9.3	15.3	0	3 11.3 2.8 4.
21	1.1 2.4 0 0.4						
22 23 24 25 26 27 28 29 30							

Total	13.7 16.9 5 10.4 17.7 0 3.4

1946

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1975 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	21.3	5.1	23.2	56.2	4.9	24.5	
12	49.8	24.3	7.5	38.8	52.8	11.9	
13	48.7	44.3					
14	31.2	0	3.9	0.3	0	4.1	
15	0.4	5.9	0	5	5.3	0.3	
16	4.5	4.5	33.8	11.4	11.5	16.9	
17	7.1	11.3	5.7	23.3	9.3	11.1	
18	17	5.6	13.2	5.9	18.8	8.8	
19	30.5	13.8	4.6				
20	43.9	7.3	8	7.3	7.5	33	
21	4.1	1.8	21.1	1.5	2	0.9	
22	0.7	1.1	0.6	0	3.3	1.9	
23	1	0.6	0.8	3.9	0.3	13.2	
24	4.1	14.2	4.5	1.8	24.4	4.3	
25	7.3	4.4	1.3	0.5	0.8	2	
26	0.3	0.8	2.5	6.7	4.5	1.2	
27	0.5	1.6	55.9	3.4	15.9	10.6	
28	2.4	35.9	6.9	37.8			
29	7.5	79.6	56.6	14.2	39.1	28	
30	64.3	4	18	55.2	7.6	79.3	
	27.4	6.5	4.2				
	21.7	20.4	3.6	5	8.1	32.7	
	12.6	49	33.4	8.8	62.2	19.1	
	92.1	43	57.3				
	113.9	37.6	103	76	35.7	70.5	
	15.9	59.3	81.5	41.2	125.5	149.8	
	117.						
	60.3	89.8	93.4	69	112.2	181.6	
	115	76.4	141.5	90	104.7	95.7	
	163.						
	87.5	72.4	125.2	69.6	99.3	95.7	
	76.1	54.9	55.5	72.4	55.4	75.1	
	67.1						
	21	36.8	39.7	35	47	34.5	
	47.5	51.1	62.3	15.1	35.9	74.9	
	18.7	31.6					
	32.8	39.3	3.2	21.6	41.9	17.2	
	36	17.7	41.6	9.1	48.4	51.1	
	15.4	44.6					
	30.6	40.9	7	26.3	38.6	17.3	
	50.5	25.9	54.2	5.4	50.4	60.9	
	45.9	67.7					

Total	1267.4 859.3 757.3 1202 822.7 1046.5 1085.1

1947

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1975 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	80.9 21.5 56.8 44.6 13.4 61.4 26 104.9 22.9 79.7 42.6 11.6 52.7 22.1 135.8 44.2 143.4 98.5 36 166 54.7 156.2 96.4 56.4 90.5 56.8 52.7 65.8 30.1 51.7 9.7 46 48.8 15 53.7 8.8 37.4 9.1 60.4 49.3 19 44.1 43.2 26 17.8 29.6 18.9 20.3 27.3 24.3 25.9 10.7 23.3 21.9 16.9 21.7 30.8 26.9 7.9 35.8 24.2 10.6 27.1 20.5 30 8.9 25.5 48.4 23.5 46.1 26.3 27.7 8.6 14 30.4 26.3 32.1 11.8 50.1 7.8 26.5 56.6 15.2 38.2 7.8 31.4 7.8 22.7 28.1 23.5 57.5 14.6 42.7 5.8 21.6 38.8 15.8 56.1 19.7 25.9 18.8 39.2 28.4 15.9 31.1 19.8 22.4 14.7 34.3 22.8 18.1 28.1 14.5 14.8 9.8 35.7 18.5 18.6 24.9 12.2 15.4 7.4 20 19.3 8.6 10 12.9 12.4 6 5.5 15.4 10.8 3.1 30 10.2 13.9 24.7 11.7 3 9.5 10.1 11.5 11.5 6.3 14.8 4.8 3.1 11 7.2 9.3 6.3 5.8 8.8 4.1 12.3 7.4 4.4 7.7 7.8 5.4 6.9 10.4 3.5 6.3 12.7 5.8 6.5 8.2 13.9 10.2 10.1 4.8 6.3 6.8 2.9 11.1 1.9 19.9 29.2 2.9 12.8 13.3 17.3 10.5 21.4 15. 6.1 28.6 6.4 38.9 9.1 20.9 24.2 5.6 25.7 16.3 10.9 7.1 4.4 15.4 5 1.7 8.7 56.3 12.7 1.3 2.5 5.4 0.2 0.7 49 15.4 22.3 25.8 7.4 19.5 10						

Total	1046.3 732.4 632.8 891.7 672.2 715.8 759.8

1948

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1975 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	4.6	2.6	1.9	2.5	3.6	6.4	1.4 0.5 0.8 7.4 0.3 0 9.5 0.3 1.8 0.7 2.7 0 0
14	1.5	0	3.1	0.6	0.5	0.2	0 0 0.1 10.1 0.4 0.9 0 0 0 0 0.1 0.6 0 0 0.3 0 (
15	0.3	0.7	0	16.2	1.5	4.5	6.4 0.2 0 0.2 2.8 0.2 12.2 2.2 6.7 2 8.1 0.6
16	1.1	5	0.3	1	0	0	23.5 1.7 3.6 9.4 2.3 0.2 4.3 15.4 1 8.7 6.3 2.7 0 1.3
17	17	1.2	12.2	7.5	1.9	6.1	0 3.5 9.1 15.8 6.7 1 2.4 0 5.7 0.4 2.5 6.2 0
18	0	0	0	8.1	0.4	2.5	1 0 0 0 0.1 0 24.8 1.6 0 0 0.2 0.5 0 17.6 38.2 25.
19	37.2	39.5	47.7	40.9	13.2	20.8	82.3 15.9 25 31.3 24 6.5 4.2 32.6 2
20	6.8	35.1	10	1.1	2	4.6	7.3 1.9 6 4.1 0 0 0 0 0 0.7 0 0 0 2.7 0 0 1.6 0
21	0	0	0	0	0	0	0 0 0 0 0.6 0 0 0.4 4.7 3.1 1.6 9.4 9.9 4.5 18.2 7.2 0.6
22	14.4	2	0.6	0.6	10.8	1.7	13.8 3.2 5.1 8.1 4.6 7.3 4.3 3.3 10.3 40.8
23	134.6	17.5	69.2	74.2	0	4.6	0.3 0 9.6 0.4 0 9.6 11.2 1.5 2.8 15.3 0.3
24	3.6						
25							
26							
27							
28							
29							
30							
31							

Total	132.4 130.2 234.3 306.9 145.6 319.6 221.9

1949

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1975 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1950

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1976 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1951

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1976 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	1.7	0	0	1.1	4.7	6.4
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	1.3	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	11.8	1	1.2	0	1.2	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	0.7 3.6 0.5 0.6 23.6 7.7 11.5

1952

1953

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - X

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – X

Sl. No.

1.

D E S C R I P T I O N

Decision and findings by the Tribunal on

important questions contd…

DailyRainfall Data for the period

from June, 1976 to May, 2013

1953 - 2175

PAGE NOS

DAILY RAINFALL DATA

FOR THE PERIOD

FROM JUNE 1976 TO MAY 2013

1953

DAILY RAINFALL (in mm) AT DIFFERENT GRIDPOINTS FOR THE MO

Year - 1976 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	46	5.9	124.2	62.4	8.4	41.4	15.5
13	9.4	5.2	37.3	18.5	12.9	54.6	51.6
14	9.3	4.3	20.4	13.3	10.2	20.2	49.7
15	87.4	50.4	115.3	137.8	13	75.1	2.7
16	0.4	0.2	24.5	5.6	3.5	1.5	10.1
17	18.3	4.2	0	5.1	3	0	23.9
18	11	27.4	17.4	12	6.7	24.3	17.5
19	0.2	0.4	0.2	0.7	0	0	0
20	0	14.3	0	0	0	1.8	0
21	4.7	10.1	7.6	1.3	13.4	4.4	16.4
22	0.3	69.1	13.7	131.5	78.5	24	46.3
23	6.3	13	6	30.3	16.3	9.6	32
24	2.6	10.2	16.9	4.5			
25							
26							
27							
28							
29							
30							

74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
5.9	124.2	62.4	8.4	41.4	15.5	21.1
5.2	37.3	18.5	12.9	54.6	51.6	16.1
4.3	20.4	13.3	10.2	20.2	49.7	6.2
50.4	115.3	137.8	13	75.1	2.7	2.5
0.2	24.5	5.6	3.5	1.5	10.1	5.8
4.2	0	5.1	3	0	23.9	8.5
27.4	17.4	12	6.7	24.3	17.5	9.4
0.4	0.2	0.7	0	0	0	0.4
14.3	0	0	0	1.8	0	0
10.1	7.6	1.3	13.4	4.4	16.4	10.8
69.1	13.7	131.5	78.5	24	46.3	5.4
13	6	30.3	16.3	9.6	32	12.4
10.2	16.9	4.5				

Total	367.8 207.6 692.4 498.6 383.1 571.2 432.8

1954

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1976 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	68.3	86.4	32.1	26.5	57.4	18.4	7.2
13	44.5	56.3	17.8	8.4	18.5	36.8	6.3
14	19.7	4.1	5.4	13.4	10	3.4	25.6
15	2.4	0.8	4.1	7.5	1.7	1.6	2.5
16	7.4	10.5	0.6	2.4	8	2.7	0.4
17	16.8	6.2	10.5	13.7	1.8	14.5	14.5
18	9	51.5	0	20.4	13.5	18.7	4.8
19	1.9	12.8	17.6	3.5	4.5	14	10
20	33.5	7.4	8.3	5.9	3.8	9.3	11.4
21	26.2	0.6	12.6	6.1	31.4	4.5	2
22	0.6	1.8	1.9	0	3.8	4.6	1.4
23	7.1	3.2	0.5	0	10.7	0.3	21.3
24	68.3	13.7	6.8	88.5	3.1	28.6	25.8
25	5.7	5.1	10.2	22.4	1.6		
26							
27							
28							
29							
30							
31							

Total	573.5 612.4 521.2 262 387.5 521.1 161.1

1955

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1976 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	2.9 4.7 0.2 4.9 6 13.3 3 0 0.6 0 0 2.2 0 0 5.4 11.6 0 9.2 21.3 3.7 7. 1.3 2.1 0 2.3 8.8 0 15.4 0.3 0 0.5 0.2 0 4.6 1 0 0 0 0 0 2.3 0.9 0 0 (0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0.1 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 1.6 0 0 5.7 0 0 0.3 6 0.3 0 21.1 0 0 0.5 3.3 0.7 0.6 11.7 0.6 0 9.2 3 8.6 8.4 3.6 1.3 1.3 2.4 2 7 4.8 2.4 6.4 1.2 0 0 0.2 0 0 12.4 2.8 0 0 0 0 0 0 0 0.4 0 0 8.3 0 3. 0 0.6 1.1 0.3 2.1 9.4 2.1 0 0 0 0 0 0 0 0.7 0 0 2.4 0 0 0 0.1 0 0 0 0 0						

Total	22.4 36.7 19.2 31.1 96.2 54 39.4

1956

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1976 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

1957

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1977 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.9 0 4.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0.9 0 0 4.5 0 0

1958

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1977 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0.4	6.2	2.4	0.1	9.4
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	1.8	0	0	6.9	0	1.4
20	0	0.9	0	0	0	6.8	2.7
21	0.1	0	3.8	1.9	0	5	0
22 23 24 25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0.1	0
16	0	0	0.3	0	0	0.2	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	16.2	6.6
20	0	0	0	0	0	25.9	14.9
21	0	0	0	0	0	0.7	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	1.5	0	0				
16	0	0	0				
17	0	0	0				
18	0	0	0				
19	0	18.4	0	0.5	0	0	2.3
20	0.5	35.7	0	0	0	0	0
21	0	0	0	0	0	0	0

Total	0 4.1 0.4 58.9 42.8 0.6 78.5

1959

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1977 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0	0	0	0	0	0.2	0
13	0	0	1.3	0.3	1	3.9	10.9
14	8.7	5.3	21.7	2.6	4.7	0.8	42.8
15	20.3	19.4	8.8	1.5	67.8	24.7	2.4
16	22.5	7.7	1.1	25.6	10.1	2.5	15.8
17	5.8	11.6	3	8.3	20.5	2	23.8
18	205.5	53.8	9.5	137.3	62	21.2	14.6
19	30.6	47.6	108	36.9	53.9	136.8	24.6
20	22.8	10.5	26.2	26	14.7	17.9	29.9
21	26.7	47.3	37	52.2	42.1	76.4	69.3
22	62.6	27.8	21.1	89	33.4	62.4	112.4
23	19.2	9.7	12.1	78.8	25.6	44.3	117.9
24	17.3	9.5	1.5	66.5	14	16.1	103.3
25 26 27 28 29 30							

Total	526.5 375.7 776 933.3 383.8 931.8 1200.4

1960

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1977 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.7 5.1 2.9 13.7 4.8 17.9 18.2 9.4 6.1 0.9 9.4 10 18 11.5 6.6 1.9 2. 8.5 4.3 21.9 12.6 6.6 2.1 1.9 22.8 6.2 17.7 32.9 15 12.6 1.8 29.5 17.2 14.9 36.8 26.5 29.9 0.6 32.4 45.2 10.6 26.1 31.6 31.6 12.9 4 48 16.1 39.8 33.5 49.5 21.4 55.4 50.3 22.2 60.5 31.3 20.7 14.8 47.6 33.8 16.6 58.1 19.1 32.5 21.3 41.6 18.4 22.4 47.2 23.5 9.9 42.4 20.3 11.9 44.4 18 6.2 3.3 10.6 36.2 10.8 26.3 48.8 4.1 7.6 12 7.9 1.6 15.1 9 3 0 3.4 5.2 0.3 3.8 6.2 10.4 0 1.8 12.7 0.7 1.6 16.8 2.5 1.2 0.6 6.8 3.9 1.2 9.6 3.1 1.8 0.2 14.9 3.9 0.9 18.3 1.7 3.9 1.2 2.8 10.8 1 3.4 4.4 2.1 1.1 4.5 4.1 1.5 5.8 4.2 2.7 2.5 11.6 5.4 6.6 21.6 9.7 5.5 1.1 13.9 4.4 3.3 16.4 7.4 3.6 0.2 12.1 2.2 1.2 16 21 16.9 29.3 20.8 17.8 19.4 19.4 20 23.8 16 42.3 27.1 17.9 49.6 26.3 23.2 37.6 57.4 26 66.6 63.6 20.9 10.6 46.4 26.9 11.9 51.8 27.1 20 13.8 33.9 23.3 22 51.2 25.2 14.9 14.3 15.4 50.1 15.9 25.4 62.2 10.2 4.9 2.8 26.6 10 3.7 32.8 18.8 12.5 2.2 21.5 17.8 6.7 25.3 20. 23.1 36.6 73.5 35.1 51.8 94.1						

Total	441.1 376.7 379 797.2 481.8 579.7 932.9

1961

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1977 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	2.9 0.6 1.1 6 4.9 0.8 9.5 6 0 1.1 11.5 2.8 0 15.1 5.5 0 7.7 10 3.7 30.1 13.6 0.7 0 1.6 10.2 0.7 0.3 13.4 8.6 0 24.6 6.2 0.4 4.9 3.6 0 6.5 0 3.1 2.3 8.8 6.6 4.8 4.3 0.5 16.4 4.7 3.5 26.8 8.5 8.9 0 3.2 7.1 8.7 1.4 16.4 37.2 0.1 16.7 26.4 12.3 18.5 0 0 0.9 0.1 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 2.1 2.4 0 1.4 3.3 0 4.4 2.1 0 0.8 2 6.3 0 7.4 3.9 24.9 6.5 8.4 14.7 0.4 0.5 0.4 0.4 0.3 0.8 0 0.3 7.7 0.7 21.9 4 2.3 4.5 0 0.9 0 1.4 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 0 0 0 0 0.3 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	76.4 68.6 86.2 96.7 69.8 95.6 109.2

1962

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1977 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0.8 0.6 0.3 0						

Total	0.6 0 0.8 0.6 0 0.3 0

1963

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1978 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 0 0 1.3 0 0

1964

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1978 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.5 6.9 0 0 0 0 0 0 0.7 0 0 0 0 0 0 3.4 0 0.3 0 0.2 0.9 0 0.4 0 1.3 0 1 4 0 1.3 0 1.2 0 0.9 4.7 0 5.9 0.3 0 1.7 0.7 0 0.2 10.2 1.9 1.3 1.5 2.9 4.5 1 7.3 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.5 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.7 4.4 0 0 0 0 0.4 0.7 8.7 8.9 0.3 17.1 15.2 5.9 1.5 5.2						

Total	11.1 4.4 20.3 20.9 21 14.8 56.5

1965

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1978 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	11.6	0.3	23.9	27.5	1.3	10.1	32.2
12	34	21.4	0.9	7.2	22.2	14.5	0.1
13	8.2	0.9	9.5	8.7	11.2	2.5	7.3
14	76.6	34.9	55.1	6.4	146.5	37.7	12.8
15	47.3	47.9	12.7	8.5	38.7	39.3	17.8
16	33.9	34.3	1.8	103.1	37.1	6.4	69
17	33.7	15.5	68.5	65.9	43.3	92	68.1
18	137	99.7	109.6	116.4	87.3	161.6	54.7
19	57.9	26.8	173.5	45.9	53.2	5.1	40.8
20	65.6	25.2	105.6	39.3	60.3	10.4	46.7
21	89.9	27.7	65.8	107.8	72.5	82.6	26.8
22	43.9	16.6	130.9	33.1	24.4	171.9	39.1
23	103.9	37.1	67	10.3	91.7	57.8	8.7
24	20.2	4.9	12.5	1.5	7	7.6	4.1
25	10.5	37.5	1.7	15.5	7.5	9.6	19.8
26							
27							
28							
29							
30							

Total	937.1 824.6 1088.2 1722.8 933.6 1115.6 1893.1

1966

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1978 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	44.4	85.7	4.8	85.5	55.1	11.8	91.2 16.9 21.4 7.3 49.4 10.2 20.8 62.
12	21	27.5	13.8	42.6	29.5	16.2	40.6 11.5 9.3 2.3 33.5 10.1 9 41.3 11
13	18.9	10.6	36.4	9.8	15.5	45.9	8.1 9.9 6.9 45.7 12.5 22.6 58.3 12.6
14	28.9	5	55.2	15.7	1.8	69.5	22.5 62.1 12.1 49.9 17.1 26.4 60.7 21.7
15	28.3	25	89.4	37.1	39.6	103	12.8 30.6 1.3 33.1 12.9 4.6 42 17.3
16	32.8	8.2	39.8	28.7	14.3	50.1	20.6 33.9 5.9 68.9 42.2 5.2 83.7 21.6
17	29.8	3.7	34.7	40.5	3.2	42.1	32 52.8 1.8 56.2 67.9 6.2 58.6 39.8
18	69.2	18.8	59.1	59.7	28.5	64.9	74.3 91.4 37.6 132 102.1 37.1 148.(
19	46.7	61	14.7	173.7	90.1	62.6	221.5 29.7 28.9 18 54.5 34.3 12.4
20	65.2	24.8	23.3	16.9	20.1	15.9	5.9 21.1 20.4 22.6 42.3 16.7 12.9
21	15.1	9.3	9	14.6	4.1	5.3	4.1 6.6 5.8 14 12 14.3 22.1 13.1 45 23.7
22	12.7	10.7	6.6	14.8	12	17.5	16 17.9 18.9 6 15 18.1 5.2 15.5 20.7
23	39.4	9.4	38.4	30.3	16.1	38.8	33.6 53 22.3 51.5 33.5 11 58.8 25.7
24	35.9	23.3	65.8	36.6	35.7	79.2	31.1 31.1 22.6 43.5 30.1 22.6 50.4
25	24.9	18.2	9.3	26.6	25.5	16.1	29.5 10.8 11.1 7.4 23 20.3 7.5 28.2
26	11.1	7.7	3.5	21.4	11.2	10.9	28
27 28 29 30 31							

Total	721.2 1020.9 385.8 1503.8 939.1 553 1754.3

1967

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1978 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.9 1.4 1 45.6 1.4 2.4 60.8 0.3 1.4 0 3.4 0.6 0 4.5 0.8 0 2.4 69 0 0 92.8 0 0 0.3 15.4 2.8 0 20.6 0 0 0.6 33.5 0 0 45 6.1 0 0 3.4 0 0 4.5 0.1 0.6 0 3.5 6.2 0 9 0 0.2 0.2 10.2 0.4 0 13.6 0.5 1 0.2 4.5 1.1 10 5.3 0.9 1.5 1.1 66.1 2 0 88.7 0.5 0 0 0.6 0 2 1.6 2.4 0 8.5 2 1.9 5.8 1 0 0 0 0 0.5 0 0 1.5 2 2 7.3 3.7 3.5 10.1 0 0 0.1 6.3 0 0 8.4 0 0 0 2.6 0 0 3.5 0 0 0 1.7 0 0 2.3 0.5 2.6 0.2 12.6 9.2 0 16.9 8.4 13.9 12.9 6.5 15.2 2.7 5 3.5 5 1.8 6.6 11.5 3.2 9.8 10.9 14.5 0.4 32.5 15.6 15.4 35.1 0.2 0.7 0 4.7 1.3 0 6 0 0 0.1 6.4 0 0 8.5 0 0 0 0 1.8 0 0.2 1 0 0.5 0 0 0.6 0.7 1.9 0.2 10.5 1.1 0 13.4 0.3 0.6 0.1 7.8 1.8 0 10 0 0 0.1 6.9 0 0 9.2 0 0 0.2 9 0 0 12.1 0 0 0 3.7 1.4 0 5 5.3 1.1 18.7 2.9 4.3 22.1 1						

Total	45 49.4 51.1 385.7 83.8 67.5 504.3

1968

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1978 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.1 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 5.7						

Total	0 0.1 0 0 0.4 0.7 5.7

1969

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1979 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 1.5 0						

Total	0 0 0 0.2 1.5 0 0

1970

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1979 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 0 0 0.6 0 0

1971

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1979 : Month - June							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0.9 0.5 0 8.7 0 7.6 0 17.7 8 0 10.5 0 2.3 0 2.1 2.7 0 5.2 0 0 0.1 9.1 2.2 0 7 0 0 0 0 0 0 0 0 0.7 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 3.8 0 1.8 0 0 2.9 0 0.4 10.9 2.7 0 0 0.6 0 2.7 0.2 0 9.9 19 1.4 0.1 9.1 0 0 1.1 1 2.6 3.4 12 3.5 12.1 1 9.7 3.2 7.5 24.4 36 40.8 49.1 53.1 19.4 56.5 47.1 44 25.6 57.6 49.4 16 65.4 36 42.8 32.9 41.8 27.1 13.4 42.9 41.2 38.2 47.7 70.1 108.8 37.4 73.5 82.6 67.1 35.5 64.7 74.4 24.5 81.4 36.3 33.1 23.7 73.5 41.2 12.9 49.7 30.8 35.2 28.8 77.6 42.9 18.7 64.7 41.1 47.9 60.9 101.6 73.5 44.1 68.6 85.3 45.7 66.5 87.8 115.3 70. 67.8 123 24.5 72.9 38.6 92.4 52.1 46.1 85.9 13.3 55.6 11.5 32.9 74.8 15.3 86.8 28.9 44.5 18.1 32.2 52.7 14.8 48.8 9.7 25.5 9.7 37 34 6.8 79.5 3.7 40 12.1 34.8 41.7 6.5 78.1						

Total	484.7 628.1 725.9 875.8 537 671 986.8

1972

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1979 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	42.3	101	15.4	35.8	86.1	19.6	93.2
13	96.5	103.4	98.3	67.4	97.9	91.4	57.4
14	33.9	102	47.3	74.5	29	73.4	84.7
15	33.7	82.6	55.3	80.6	47	99.1	105.4
16	145.7	39.9	130.9	85.8	164.7	21.5	54
17	39.2	101.6	115.8	27.5	135.4	5.8	47.8
18	23	9.2	23	32.2	10.9	57.7	7.7
19	29.3	13.9	4.6	47.7	2.2	11.5	0.6
20	15.7	8.5	17.4	11.8	10.8	2.7	13.6
21	5.9	8.4	1.8	5	7.3	2.1	3.7
22	0	0.2	0.7	0.6	0.5	0.6	0.3
23	0.3	0	0	1.9	4.6	0	0
24	21.6	7	1.1	8.5	12.8	2.8	22.7
25	1.9	1.1	0.4	1.6	0.8	0	11.3
26 27 28 29 30 31							

74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
141.9	23.9	62.6	135.6	24.2		
129.1	53.8	75.2	25.9	58.4	70	
99.5	45.6	71.7	22.8	59.6	97.9	
160.8	91.3	148.7	20.4	69		
145.8	36.8	110.3	30.7	92.7		
98.3	51.7	33.5	92.4	2.9		
23.5	33.5	18.9	45	6.6	7.7	7.
46.1	4.6	3	5.9	36.1		
12.7	3.5	10.1	18.5	11.7	8	
2.4	0.7	0	3.6	1	2.3	1 1.5 0.
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4.1	0	1.8	0	1.9	2.3	0 13.
101.4	47.9	56.8	25.2			

Total	783 1251.4 466.1 1075 1326.1 534.8 1564.4

1973

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1979 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	6 8 1 3.6 0.2 0.4 4.7 3.7 0 0.4 1.6 0 5.6 2.4 0 0 0 1 0 0 1.3 0 0 0 0						
15	0 10.8 1.4 0 0 0 0.4 0 0 0.5 0 0 0 0.5 0 0 0.6 1.2 4.7 0 0 0 0 0 0.3						
16	1.1 0 0 0 0 0 0.7 1.8 0 0.7 8.1 0 0 0 0.2 0 5.2 0.4 5.7 7.2 5.3 0 3 4						
17	0.3 7.8 5.7 2.2 0 0.1 6 0.4 0.8 8.1 2.6 0 0 3.4 0.2 1.2 4.6 1.9 0 0.1						
18	6.5 0.4 12.3 9.4 1.5 0 0.2 10.5 0.7 7.4 14.4 2.9 0 0 4.8 0.3 0 6.4 0						
19	0 0 0 0 0 0 0 0.1 6 0.4 0 8.1 0 0 0 3 2.5 0 4.2 0 0 2 11.1 1.4 0.7 14						
20	2 0 0 5.2 0.3 0 6.9 2.3 0 0 0 0 5.6 0 2.6 0 0 0 0.7 0 0 1.5 0 0 0 0 0						
21	2 0 0 0 0 0 0 2.7 0 0 0 0 0 0 4.2 2.6 0 1.6 0.9 0 2.1 14.1 13.8 23.2						
22	11.7 14.6 6.4 4.4 11.9 27.9 8.8 19.4 23 8.1 21.4 18.8 19.9 19.3 11						
23	22.4 28 2.4 2.9 0 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	93.3 80 58.2 118.8 77.2 100.8 130.7

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1979 : Month - December

Year - 1980 : M onth - J a nuary

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1980 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

1976

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1980 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0.4 1.9 0 0 0 0 0 0 4.9 0 0 0 0 0 0 5.1 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 5.1 0 4.4 0 3.4 15.7 0 1.3 0.2 0 0.1 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.3 0 3.3 17.7 0 6.4 0 0 0 0 0 0 0 0 0 0 0 0 0 7.1 0 18 11.6 6. 1.9 0.9 0 0.7 0.1 0.6 3.5 0 9 0 0 0 0 0.8 0 8.2 0.4 0.3 0.3 0.6 1.4 3 12.7 0 0 0 0 4.2 0 0 0 0 0 0 0 0 0 0 0 0 0 9 10.6 0 0 0 0 0 0 0 0.5 0 2.6 1.1 0 0.3 0 0 0 0 0 0.2 0 0 0 0 0 0 0.6 1 1.2 0.3 0 0.2 0.3 0 0 0 0 0 0 0 7 8.3 0 0 0 0 0 0 0						

Total	8.5 10.2 21.3 21.5 63.2 22.5 63.7

1977

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1980 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.9 0 3.2 1.5 1.3 14 3.3 5.8 0 2.4 12.3 3.1 16.1 14.3 1.2 2 2.8 0.8 0.6 0.2 0.5 8.1 12 11.3 5.7 3.1 3.9 2.9 22.7 9.9 43.5 41.7 18.7 37.(34.3 21.1 11.6 34.4 113 26.3 58.4 117.1 11.5 27.8 18.8 32.4 32.2 27.3 35.3 41.5 8.2 54.9 35.2 30.7 38.2 20.9 14.3 2.6 27.3 15 11.9 6.2 10.9 9.8 6.4 10.2 11.5 8.7 11.4 9.8 16.9 1.8 41.4 21.6 7.5 47 12.8 9.8 1.1 30.6 57.8 12.7 25.1 55.1 29.4 8.7 68.5 27.3 13.9 26.1 10.3 11.6 2.9 34.6 10.7 11.2 15.7 5.2 30 31.9 13.7 41 20.9 15.1 41.2 13.1 9.5 35.7 63.7 22.2 23.7 63.5 28.7 17.6 39.8 29.5 16.8 53.9 21.3 39.2 34.3 41.1 50.6 20.4 55.7 46 43.9 42.9 42.4 47.7 34.7 61 43.7 84.7 98.4 65.5 41.5 51 40.6 28.5 133.2 69.4 231 133.9 60.2 133.4 85.3 46.2 42.7 8.4 99.7 71.4 14.5 113.4 41.1 43. 11.3 92.2 73.7 28.3 103.7 28.2 40.6 11.6 102.3 44.1 43.6 113.3 40.7 39.1 11.5 81.9 54.4 19.1 89.9 54.1 77 5.3 50.3 38.3 28.2 55.9 55.3 54 41.9 169.8 69.9 81.6 179.9 57.3 49.4 8.5 80.1 46.5 22.1 87.1 72.5 114.8 41.5 139.3 96.5 87.3 149.1 81.5 135.7 28.1 151.3 129.4 55.9 163.7						

Total	1054.3 995.7 1021.2 1761.3 1032.3 1091.2 1718.2

1978

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1980 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	48.8	30.8	94.1	56.7	24.7	54.3	42
12	90.3	39	29.2	18.8	82.4	65	45.1
13	203.6	51.7	54.3	10.4	52.9	47.7	40.1
14	23.3	118.9	33.7	34.5	7.1	55.7	28.8
15	11.3	62.5	21.8	27.5	4.5	43.8	37
16	20.2	42.9	46.1	54.7	12.1	56.2	24.2
17	25.3	65.7	34.9	36.6	16.7	131.1	48.8
18	10.6	28.2	36	7.2	10.4	9.1	18.4
19	9.8	12.4	7.4	8.2	32.8	13.3	10.7
20	22.4	20.3	7.1	25.1	14.8	10.4	24.3
21	41.9	42.3	72	73.4	37.8	28.5	63
22	27.9	35.9	69.5	45.7	48.2	68.6	21.9
23	13.2	13.9	59.2	30.9	19.1	62.3	19.1
24	19.6	22.2	25.1	90.9	46.4	21.1	97.3
25	34.6	45.7	14.2	39.5	33.1	6.2	38
26	20.9	20.2	38.2	66.9	41.3	14.8	64
27							
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Total	963.2 934.2 794 1950.7 1097 795.5 1990.3

1979

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1980 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
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3 4							
5 6							
7 8							
9 10							
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14							
15	6.3	0.6	0.3	23.2	6.6	2.7	26
16	1.7	0.1	8.7	2.4	0.1	0.2	0
17	0.1	0	1.9	0	0	0.1	9.2
18	0	0	3.4	5.2	0	2	0.7
19	0.4	0.9	6.4	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23							
24							
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27							
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29							
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31							

12.4	16.7	0.9	23.2	1.7	27.2	24.9	2.7	0
1.4	0	0	2.2	0	0	0.2	14.9	1.1
2.8	9.9	0	0	0	0	0	0	0
2.1	1.2	0	2	0.6	0.6	0.1	0	1.9
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
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Total	28.1 25.8 3.7 84 12 42.4 91.8

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1980 : M o nth - De c ember

Year - 1981 : M o nth - Ja n uary

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1981 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1982

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1981 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0.6 0 0 19.2 0.2 0 0.3 1.7 0 13 0 0 0 0 0 0 0 0 0 0 0 0 0 5.7 0 0 0 0 0 0 5.2 0 0 0 0.4 3.2 0 5. 0 0 0 0 0 0 0						

Total	0.2 0 0.3 2.7 3.2 0 48.9

1983

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1981 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	4.4	1.9	6.7	12.1	1.1	19.4	35.3 2.5 2.2 5.3 2.4 10.3 4.3 0.1 42 3.4
12	15.1	22.2	9.2	39.7	18	67.7	2.4 60.9 30.5 118.1 66.2 16.7 163 15.5
13	136.7	191.2	28.5	116.3	82.9	66.4	0 34.2 48.5 2.1 46.4 59.8 59.3 1
14	0.5	2.6	8.2	3.9	2.3	22.8	0.3 0.3 7.2 6.2 1.2 4.4 16.6 0 4.9 3 19.1 2
15	1.9	11.4	0	4.1	8.4	2.4	8.4 10.6 2.5 0 3.6 3 4.7 2.3 1.1 8 1.8 47.6 3.
16	7	5.2	7	24	0.9	10.7	28.6 2.1 8.2 20.8 126.7 7.8 95 113.2 2.6 133.1
17	3.1	41.9	9.5	70.4	22.7	2.4	18.5 18.7 4.1 4.1 61.3 4.9 6.2 81.4 18.5
18	8.2	8	23.7	3.8	2.1	7.4	1.7 34.3 14 62.5 7.2 23.6 50.3 3.1 42.9 16.1
19	34.6	24.3	81.8	34.2	40.1	134.8	27.9 121.3 162.7 46.9 138.3 112
20	35.4	10.6	17.7	11.7	25.3	28.2	11.7 39 20.2 25.5 16.6 13.9 71.4 12
21	77.2	6.3	11.5	31.5	22.3	27.5	19.3 26.9 18.2 55 20 40.8 41.4 33.9
22	139.6	13.1	100.5	132.5	44.2	110.5	96.2 119.8 11.3 91.5 67.3 47.9
23	132.9	73.9	72.3	27.8	48.3	104	61.9 78.9 86.5 55.5 27.9 47.9 56.3
24	49.2	36.1	52.5	50.5	19	39.9	53.7 31.9 26.6 42.4 66.1 18.8 23.3
25	43.7	36.8	27.2	32.7			
26 27 28 29 30							

Total	1565.8 290.1 1260.5 1239.4 758.8 1367.5 919.9

1984

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1981 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	175.3	73.2	204.2	127.4	93.5	184.7	58
12	166.3	121.8	73.1	103.1	35.7	50.8	69.8
13	78.3	92.6	56.2	74.9	57.8	98.3	35.7
14	17.7	36.8	64.2	17	94.5	14	66
15	34.7	5.8	59.3	16.6	90.8	7.1	14.8
16	7.4	42.4	19	101	7.8	21.2	65.1
17	20.3	95.8	25.5	80.6	4.6	43.6	65.6
18	3.7	121.8	30.1	80.1	7.5	35.8	66.8
19	14.3	55.1	93.8	97.7	41.4	44.7	73.7
20	86.4	33.7	105	48.9	98	23.8	63.1
21	54.2	19.7	60.6	21.4	70	11.9	31.1
22	22.4	33.8	14.6	22.6	12.1	28.4	31.7
23	10.3	24.5	10.1	11.8	7.3	6.1	6.1
24	7.7	6.8	0.5	4.7	3.1	1.9	1
25	1.8	7.5	3.6	15.2	4.7	2	15.5
26							
27							
28							
29							
30							
31							

93.7	156.4	157.9	86.										
54.9	105.1	62.7											
119.1	66.2	136.3	43.9	7									
11.8	69.9	16.2	53.3	1.3	16								
3.9	61.3	17	93.1	7.8	19	57.9							
105.1	23.8	91.9	23.8	47.1	92.1								
118.7	36.2	76.6	8.7	34.8	53.								
76	39.1	124	7.2	31.1	81.7								
85.7	44.3	70.5	26.4	51.1									
13.1	82.1	24.9	61.2	7.5	27								
46.8	17.7	47.4	18	36	4.8	22.6	40						
6.1	59.7	14.7	12.6	9.4	12.1	10							
6.1	7.7	11.4	8.2	13.4	0.4	1.4	5.9	1.9	1.				
1	6.3	12.3	1.3	1.6	8.2	0.5	2.4	4.1	11	4.8	5.9		
8	4.3	2.4	4.3	4.7	0	7.7	10.7	1.4	13.5				

Total	1149.6 1939.1 747.8 1221.9 1606 846.4 1930.6

1985

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1981 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	4.8	9.8	0.8	1.1	1	0	2
15	2.6	0	1.8	0	0	0.3	0
16	5.7	0	0	0	0	1.8	2
17	1.4	8	0	0.9	8.2	0	12.4
18	1.7	0	4.2	0	0	0	0
19	2.1	0	0	0	0	0	0
20	0	0	0	0	0	0.8	6.6
21	21.7	4.4	0.8	4.1	21.1	0	0.2
22	0.2	2.1	35.6	0	0.7	6	0
23	11.1	7.2	7.7	6.2	10.9	34.7	5.9
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	7.5	2.8	9.9	3.9	5.7	2.8	4.1
15	4.2	0	0	0	0	0	1.7
16	2.5	10.3	31.5	2.7	5.1	0	25.6
17	13.4	12.9	0.7	1.8	5.3	0	1
18	0	0	0	0	0	0	0.2
19	0	0	0	0	0	0	0.7
20	2.7	0	0.1	1.5	10.5	1.2	2.8
21	0	11.8	0	0	0	14.5	0
22	6	0	1.1	2.5	28.5	2.2	1.6
23	6.2	10.9	34.7	5.9	4.4	1.9	7.3

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	1.6	1.7	0	0.3	6.5	1	
15	0	0	0	0	0	1.8	0
16	2.7	5.1	0	25.6	7.7	0	2.7
17	5.9	1.4	0	2.8	1.4	3	
18	0	0	0	0	0	1.7	0.2
19	0	0	0	0	0	3.6	1.8
20	0.7	2.9	4.9				
21	9.9	34.3	0.5	2.6	2.3	0	
22	5.5	1.8	2.2	15	18.7	8.2	
23	1.9	7.3	3.6				

Total	102.3 280.9 33.9 62.7 70.5 70.7 76.1

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1981 : M o nth - De c ember

Year - 1982 : M o nth - Ja n uary

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1982 : Month - February

Year - 1982 : Month - March

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1982 : Month - April

Yea r - 1982 : M onth - M ay

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9.7

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11.8

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Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MONTH OF

Ye a r - 1982 : Month - June

Yea r - 1982 : Month - J uly

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

43.4

0

0

0

4.9

0

3.1

0

2.1

56

47.9

46.3

0.5

14.6

38.1

48.3

55.1

32.1

75.1

30.4

56.3

69.3

171.5

86.2

93.8

4.7

1.7

1.1

0

0

982.5

2.1

1.6

14.1

12.4

16.7

22.9

8.6

30.2

3

12.3

31.4

33.5

33.5

42.3

36.8

54.8

50.4

63.4

86.6

77.1

58.9

54.2

57.1

95.9

43.2

27.3

14.3

0

23.9

0

1008.5

33.2

3.1

0.8

0.8

2.6

0.8

0

10.8

23.7

86

62.4

104.3

22.6

20.6

65.4

47.2

31.8

22.3

9.3

11.4

22.7

108.8

204.1

79.2

26

4.5

0.4

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0.9

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1005.7

20.7

1.7

2.7

0

0

0.3

0

0.8

0

61.6

54.7

58.9

3.2

36.3

31.7

65.4

54.7

44.9

62.3

61.8

41.5

57.6

79.1

113.4

78.5

34.5

1.9

1.1

1.3

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970.6

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1.6

3.3

10.8

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19.8

56.7

24.2

32.1

70.7

164.3

31.1

26.9

26.9

39.8

22.6

23.7

2

0.9

0

0

559.4

8.5

0.9

0

1.7

0.2

0.1

0

0.2

46.8

116.7

59.5

31.6

31.6

47.5

86.9

57.3

16.1

27.5

49

67

28.6

120.8

130.9

80

7.6

12.6

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1

0.7

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1031.3

2.4

4.6

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0

3.2

37.6

13.3

25.4

10.6

18.3

43.3

43.4

50

50.7

110.4

187

25.3

37.5

29.8

67.3

41.3

40.2

4.1

1.8

0.6

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848.1 Total

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1.8

27.3

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45.8

17.2

56.5

0.6

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3.8

25.6

10.6

36.3

32.4

31.6

42.4

21.2

35.7

125.8

52

61.4

63.7

76.4

142.7

57.2

16

17.9

92.1

138.6

45

51.2

1369.6

1.5

2.6

13.9

26.9

27.3

48.2

13.4

1

3.2

22.1

24.2

54.6

23.8

55.8

81.1

80.3

80.1

115.3

102.2

105.3

86.7

81.1

79.1

88.4

71.2

57.2

66

169.8

158.8

117

118.5

1976.6

3.9

18

51.1

65.8

5.6

3.9

2.8

0

5.7

15.4

14.8

45

43.4

56.1

14.8

15.4

8.4

17.8

46.4

37.9

41.9

36.9

39.1

114.6

17.9

13.8

26.7

72.2

94.5

25.8

33

988.6

0

0

8.4

33.3

16.6

12.8

37.8

0.4

7.4

8.7

52.9

12

23.9

30.1

28.1

36.9

38.1

47.3

76.5

78.8

80.6

83.5

74.6

156.1

50.4

22.4

43.8

104.6

253.6

47.7

98.2

1565.5

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7.3

15.7

9.3

7.9

10.8

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25

13.2

20.2

49.4

81.9

92

81.8

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121.1

92.7

77.9

35.3

74.3

30

24.7

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152.4

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109.2

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74

25.9

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3.9

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3.8

24.8

24.2

45.9

36.6

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42

69.8

34.7

68.9

76.3

43.2

29.5

21.3

86.9

135.4

82.8

21.2

17.4

1127.3

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13.7

28.7

16.3

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28.7

78.1

86.4

71

125.9

114.4

94

119.1

87.2

53.1

72.6

79

34.1

35.1

109.3

250.5

143.9

82.9

1811.1

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1982 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	46.6	183.8	19.5	80.4	36.6	17	92.7
12	52.4	175.9	43	119	108.4	57.7	83
13	52.8	26.5	33.1	3.6	12	20	13.2
14	25.3	59.9	14.7	14	13.1	11.2	18
15	92.3	56.1	91.6	97.2	58.7	76.3	54.8
16	62.5	112.5	31.4	57.9	92.1	37.5	61.1
17	177	193.6	97.3	70.7	79.3	147.4	102.6
18	42.4	75.2	22.7	93.4	74.1	106	26.4
19	14.5	130.9	113.4	86.5	171.1	38.9	83.3
20	100.1	25	69.1	62.5	32.6	73.3	32.1
21	42.2	5.9	11.9	24.7	19.2	45.7	42.9
22	27.9	72.1	10.8	28.6	36.7	27.7	59.3
23	69.3	24.8	108.8	5	17.2	39.7	26.7
24	35.4	77.9	25.7	22.6	9.8	19.1	11.5
25	14	2.6	16.5	10.1	16	14.3	12.4
26	12.1	14.2	19.1	57.4	30.3	41.8	9
27 28 29 30 31							

Total	1451.3 2160 869.5 1799.7 1615.2 1181.4 1914.2

1991

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1982 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	9.4 4.9 0 3.5 0 0 0.9 0 0 0 0.3 4.1 0 3.5 0 0 0 0 0 1 0 11.4 0 0.2 0.(						
15	0 0 0 9.6 0 1.2 0 0 9.3 0 0 7 0 0 0 0 0 0 0.8 0 0 1.6 0 0 0 3.8 3.4 0						
16	4.4 2.3 1.6 5.8 8.6 3.2 2.5 2 2 28.4 0 0.5 0 7.7 0.8 2.8 9.2 0 0.5 0 (						
17	0.6 9.2 0 0 0 0 0 0.1 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0						
18	1.8 0 0 0 0 0 0 0 0 0 0 1.2 0 1.6 4.5 0 0 0 0 0.3 11.8 5.7 3.7 1.6 0.4						
19	0.8 21.6 2.5 2 0.3 3 7.1 7.5 26.2 0 4.3 1.4 15.1 0.5 17.1 6.5 0 7.6 (						
20	4.1 0 1 2.3 0.2 19.9 0 0.5 0 0.7 13.7 2.1 26.8 0 0 12.8 0 0 5.9 18.4						
21	0.9 0.5 3.7 0.6 6.6 8.6 20.5 16.8 14.2 0.2 12.4 3.1 6.7 18.3 0.5 2.6						
22	5.5 7.3 36.6 3.1 26.3 0.2 3.8 10.1 3.5 3.2 0 0 0 0 2.7 0 0 0 0 0 4.8						
23	0.2 0.3 0 4.8 0 0 0 0 0						
24 25 26 27 28 29 30 31							

Total	78.7 188 31.8 65 56.6 80 164

1992

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1982 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 1 0 0 0 0 0 0 2.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.2 0 0 0 0 0 0 0 0 0 0 0 0 1.8 0 0 0 0 0 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 15.5 0 0 0 0 0

1993

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1983 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

1994

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1983 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0						

Total	0 0 0 0 0 0 0

1995

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1983 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0.3 0 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.9 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0.5 0 0 2.2 0 0 0 0.6 0 0 0.9 0 0 8.3 8.2 20.8 7.2 19.4 11 3.2 25.7 23.9 36.5 38.4 31.9 43.2 26.3 24 27.3 22.9 53.3 30.8 28.1 50.1 12.6 20 27.7 41.5 17.7 27.4 26.3 39.7 26.6 35.9 9.9 19.2 52.3 39.5 35 46.4 16.6 33.7 31.3 41.7 54. 24.9 9.4 8.9 33.6 34.4 19.9 54 29.7 30.1 11 43.2 21.7 18.3 21.5 57.8 50.8 12.4 36.6 41.3 26.1 47.2 59 76 20.2 58.1 48.1 41.6 92.5 79.1 92 51.3 128.4 89.8 77.3 79.9 90.7 93.2 58.5 94.3 119.3 64.8 91.6 68.3 128.4 76.1 167.5 222.2 72.7 291.6 69.2 119.8 98 176.5 144.4 88.3 217.4 75.1 85.7 93 153.8 98.7 132.5 171.1 34.7 62 58 56 34.8 12.5 42.2						

Total	737.2 900.9 648.1 1132 1008.4 757.7 1312.5

1996

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1983 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	44.6	13.5	31.9	39.3	16.8	53.3	24.8
12	20.8	32.3	39	7.3	41	30.1	18.6
13	54.7	20.2	16	11.7	20.6	27	21.4
14	10.5	70.1	35.5	64.7	40.1	33.2	53.3
15	100.5	50.9	217	99.5	99.5	134.7	80.3
16	83.4	91.8	64.2	131.1	89.4	103.4	133.3
17	128	156.2	87.4	109.2	104.8	71.8	69.4
18	58.5	92	72.4	77.3	71.3	49.3	84.6
19	106.3	18.6	68.7	18.8	44.8	73.4	21.4
20	76.9	17.5	44.9	10	16.5	23.7	12.9
21	14	8.2	34.6	5.9	13.9	16.2	20.3
22	2.9	10.6	15.7	3	12	37	4.5
23	10.1	3.8	2.9	18.9	8.5	27.7	11.9
24	5.6	18.9	1.4	20.3	16.2	10	42.6
25	9.3	57.3	18.9	33.9	27.3	44.6	36.6
26	24.1	6.9	16	31	22.6	11.2	7.7
27 28 29 30 31							

74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
27.3	19.5	34.6	15.4	20.7	11.4	12
45.9	11.1	8.5	4.8	14.7	6.9	23.9	46.2
50.2	10.4	25.5	95.4	5.6	78.3	26.2	6	5.2
22.9	11.9	3	16.7	6.4	9.7	9	5.6	6.5
42.6	7.2	26.1	39.2	30.1	25.2	34.7	32.6
44.6	36.6	16.1	23.4	24.8	45.5	42.5	11.6
31	22.6	11.2	7.7	6.3	7.1	13.8	9.2

Total	1623.3 1365.8 1168 1418.9 1016.6 1340.9 1391.3

1997

Date

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Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1983 : Month - O c tober

Year - 1983 : Mo n th - November

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

0.7

2.7

5.3

1.6

1.3

7.2

10.2

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1.9

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10.8

1.4

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1.3

19

3.7

11.2

5.9

3.1

87.5

6.6

19.2

14.4

6

15.7

10.2

9.2

2.2

0

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1

1.8

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2.5

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1.5

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4.8

2.6

1.1

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4.7

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13

1.9

2.6

3.8

2.7

136.5

1.5

2.7

12.9

3.4

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4.7

3

1.4

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2.7

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1.2

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1.6

29.5

37.9

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109.8

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11

1.9

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0

7.9

15.3

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16

17

18

19

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23

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25

26

27

28

29

30

Total

1998

4.8

7.2

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26.7

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40.7

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1.4

2.2

4.7

0.8

0.6

3.2

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11.5

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1.2

1

2.2

6.2

4.4

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17

3.2

1.1

0.4

2.9

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7.6

15.1

2.1

2.1

0.4

15.1

0

0

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2.8

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6.7

0

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0

0

5.5

0

0

0

0

49.8

0

4.5

1.5

15.6

3.6

31.1

0

0

0

0

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0

0

0

0

0

56.3

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1983 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0.4 0 0 3 0 0 0.2 1.7 0 2.9 3 1.7 0.2 25.1 0 11.8 13.2 0.3 0.3 1.3 4.9 0 0 0.1 0.3 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	32.5 0 14.9 19.3 0.6 2 2.4

1999

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1984 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 0 0 0 4.7 0 0 0 0 0 0.2						
18	1.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 2.1 0 0 0.2 6.2

2000

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1984 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.8 0 0 1.2 0 0 0 0 0.8 0 0 0 0 0 0 0 0 0 0 0.2 0 0 3.2 0 0 0 0 0 0 0 0 0 0 0.1 0 0 1.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 2.2 0 0.2 2.2 0 0 0 0.2 0 0 3 0 0 2 1 1.2 0 0.3 0 2.5 0.4 0 5.5 0 0 0 0 0 0 0.2 0 0 0 0.3 0 0 4.8 0 0 0 0 0 0 0 0 0 0 0 0 4.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	1.5 0 4.9 4.4 0.8 6.9 20.4

2001

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1984 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	3.4	0	0.3	0	0	0	0
12	13.9	5.2	6.5	2.3	12.8	0.7	0.2
13	19.4	5.1	53.1	7.8	2.1	48.7	34.9
14	10.7	42.5	67.6	10.2	43.8	35.7	44.9
15	23.6	5.7	47.7	16.1	3.9	37.9	12.4
16	28.8	22.3	39.7	52.4	13.9	14	95.5
17	174.1	112.1	67	60.6	154.8	52.4	106.2
18	116.5	48.1	83.7	53.4	73.7	30.7	96.5
19	85.6	110.4	28.6	82.4	68.5	78.1	31.6
20	31.2	18.8	9.4	27.9	27.6	28.4	2.6
21	9.3	6.5	20.4	4.6	11.9	6	20.9
22	1.7	8.7	14.1	6.3	3.7	3.6	8.7
23	26.3	20.4	9.1	30.2	13.2	7.4	32.3
24	21.8	47.8	8.6	11	20.6	15.7	38.4
25	140.2	148.6	150.4	192.8	119.3	92.1	17.1
26							
27							
28							
29							
30							

Total	962.6 997.1 976.1 1109 849.4 949 1237.1

2002

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1984 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	53.4	52.8	89.3	48.2	33	72.6	30.3
12	72.6	9.1	21.5	4.2	6.6	24.1	9.8
13	24.8	20.1	7.1	22.8	34.7	22.5	29.8
14	28.7	40.2	9.5	33.8	30.4	24.1	32.2
15	21.2	20.5	6.2	9.7	16.3	11.6	38.8
16	39.2	12.3	17.1	49.4	13	34.3	26.1
17	26.8	18.6	7.5	40.5	25.1	11.4	51.1
18	11.5	38.7	6.7	11.6	18.2	16.4	24.8
19	29.9	3.4	22.7	24.1	21.1	37.2	17.1
20	46.5	13.3	31.1	41.8	17.4	32.6	11
21	16.3	12.4	21.2	21.1	26.9	24.3	21.3
22	14.1	6.5	5.9	3.6	3.8	2.4	4
23	5.9	1.5	5.9	7.6	7.6	9.7	8.3
24	6.4	22.2	7.1	10.3	15.8	5.8	11.5
25	58.1	14.5	24.6	29.6	4.4	22.7	32.9
26							
27							
28							
29							
30							
31							

Total	643.6 939.3 405.7 655.1 740.6 496.5 856.1

2003

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1984 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.5 0 0 0 0 7 0 0 0 0 0 0 11.7 0 0 0 0 0 0 10 0 0 0 0 0 0 16.1 0 7.8 2.5 0 0.6 3 16.8 6.1 5.6 18.8 9.3 8.5 15.4 25.1 23.6 4.5 7.7 4.6 44 10.1 12.7 11.9 4.3 17.5 4.2 6.5 18.1 27.9 19 21.7 4.6 57.8 62 8.4 30.9 9.9 9.9 21.7 9.3 8.2 27.4 13.2 12.6 32.4 35.8 45.2 26 22.2 10.2 26.6 20.4 12.7 25.3 16.9 10 1.8 7.1 0 0 1.2 0 4.4 0 2 0 0 0.2 6.8 0 0 0 0 0.3 29 16.6 4.2 0 0.8 0.6 0 0 5.6 0 1.7 0 0 0 1.8 11.2 0 4.3 0 10.7 0 5.7 0.8 0 0 0 0.5 0 11.2 6.3 0 0 2 1 0 0 13.7 3.6 2 0 0 0.9 0 0.2 10.7 2.2 0 37.1 0.2 0.5 2.6 0 4.6 4.5 4.4 1.8 1 3.4 2.7 6.8 0 0 1.6 8.3 0.5 2.5 1.1 0 19.1 0 2.8 3.3 0 0 0 0.6 2.4 0.9 0 0 0 0 0 0 0 0 0 0.6 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 5.7 0 4.7 0 0.3 2.6 0 0.2 0.1						

Total	135.5 135.6 154.1 279.8 144.9 285.2 151.8

2004

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1984 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2005

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1985 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2006

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1985 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	5.7	0	9.5
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0.2	0	0	2.8	0
19	0	0	0	3.7	0	0	0.4
20	0	0	0	0	0	0	0
21	0	0	0	0	0		
22 23 24 25 26 27 28 29 30							

Total	0 0 7.6 0.2 8.5 0.7 17.2

2007

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1985 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	5 1.5 14.2 12.2 1.9 14.7 8.5 8 2.6 15.4 4.5 1.5 8.1 11.6 9.6 3.9 12. 34.2 1.9 10.2 18.7 4.4 11.3 18.7 11 0.3 11.9 5 1.1 2.2 0.3 0 0.4 3.6 0 35.2 19.2 5 13.9 5.7 8.1 14.4 134.8 46.3 114.9 93.8 7.6 40.2 23. 17.2 7.9 25.4 17.9 9.5 38.2 15.1 21.2 11.8 18.3 45.5 11 29.1 38 16.6 19.8 23.7 27.2 6.8 31.5 24.6 22.6 27.3 17.9 36.3 10.9 37.7 22.3 52.9 18.3 33 37.9 6.5 41 16.4 31.7 9.8 54.7 14.5 0 19.6 24.7 19.4 11.7 21.8 10.8 1.2 31 2.1 24 22.3 14.2 19.1 37 41.1 17.3 88.2 38.1 80.7 117.2 62.1 67.4 40.3 88.4 55.3 74.6 91 131.6 47.4 92.9 41.3 105.4 11.4 75.2 103.8 51.3 173.4 37.4 127.2 56.1 145.7 24.1 43.1 131.5 137.5 64.8 67.2 39.1 5.5 34.1 9.8 62.6 60.4 40.2 16.3 10.6 43.6 13.5 18.2 57.1 32.8 6.5 12.4 53.6 19.8 44.9 75.9 5 11.7 25.9 63.8 12.3 76.3 41.7 25.1 15 35.3 94.3 32.9 198.3 102.8 133. 120.3 50.5 137.5 67.9 203.8 147.8 262.8 155.6 73.6 127.1 90.4 78.4 80.5 123.8 90.6 64.4 77.8 24.7 20.3 48.6 11.8 36.5 39.1 34.8 19.2 17.1 37.2 9.6 14.4 26.8 36 32.6 44.4 30.5 8.9 62 38.7 44.4 37.6						

Total	1560.8 1289.2 1333.5 1375.9 806.6 1322.2 1041.4

2008

Date

1

2

3

4

5

6

7

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19

20

21

22

23

24

25

26

27

28

29

30

31

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1985 : M onth - August

Year - 1985 : Mo n th - September

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

68.3

86

29.6

13.6

31.1

23.4

27.3

39.8

54.5

24.2

14

11.3

43.6

24.9

28.8

3.7

3.6

5.1

14

6.8

5.2

9.2

14.7

6.7

14.8

19.7

14.9

7.8

6.4

16.9

4.4

674.3

173.8

148.5

117.4

116

105.2

115.1

40

75.9

71.2

98.5

81.5

81.5

83.1

66.4

49.3

46.6

35

39.1

38.5

39.2

38.9

41.3

6.6

2.8

5.1

12

9.5

2.8

9.9

2.5

17.8

1771

93.2

102.2

15.5

6

16.7

12

11

11.7

58.3

21

7.1

4.1

34.1

20.4

28.2

5.2

2.9

12.6

17.2

16

12.9

20.7

5.8

5.6

6

6.2

8.4

7

7

13.1

2.3

590.4

124.8

157.7

35.4

32.8

32.4

15.9

16.8

36.3

86.8

24.8

13.7

13.5

37.9

58

41

7.4

4.5

3.6

3

18.1

4.8

9.7

14.5

6.7

14.3

19.5

17.8

12.1

2.9

13.1

0.7

880.5

139.9

138.3

67.8

48.8

21.6

24.4

27.8

34.9

58.9

38.3

28.5

25.6

38.1

26.3

26.5

13.7

5.7

2.9

3.2

9.7

5.8

7.1

10.9

16.4

8.4

24.1

9.6

5.6

9

8.8

2.2

888.8

138.7

117.8

31.9

17.6

17.9

15.3

24.9

37.3

40.3

35.6

19.5

21.4

42.5

21.3

14.7

17.1

6.9

13.8

10.3

6.6

7

11.3

9.8

17.3

16.1

9.5

8.4

9.5

3.6

6.2

5.2

755.3

186.4

60.4

32.5

28

26.3

27.6

27

48.3

78.3

56.4

45.8

26.2

48.7

48.9

47.7

30.9

9.7

6.1

1

6.8

2.6

8.3

10.3

16.2

18.9

34.6

24.5

25

7.3

29.9

1

1021.6

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

2009

0

0

0

0.5

7.4

16.4

12.1

16.9

18.9

2.4

2.4

1.8

2.7

0.4

1.3

0

0

0

0

0

0

0

0

0

0

1.6

1.8

0

3.2

11.6

101.4

5.6

10.1

5.3

5.4

1.9

4.8

7.2

3.7

0.5

5.6

0.1

5.4

2.7

5.8

1.7

0

0

0

0

0

0

0

0

0.6

1.5

2.6

4.1

7.4

7.1

89.1

1.3

0

1.5

0

3.3

0.8

1.5

30.4

15.1

2.3

8

0.3

3.7

1.8

7.1

0.2

0

0

0.9

0

0

0

0

0

0

5.3

3.5

0

1.5

5.7

94.2

0

0.2

0

0

6.4

14.5

5.8

24.5

8.6

22.2

6

2.8

5.4

1.6

1.2

4.2

0

0

0

0

0

0

0

0.1

0.5

17.4

20

0.3

17.7

159.4

0

1.9

0

1.6

0.7

24.4

7.9

14.6

7.5

6.2

5.1

10.4

7.1

0.5

0.3

0.2

7

0

0

0

0

0

0

1.1

0.2

9.8

7.8

17.7

6

138

1.7

0

0.9

0

1.1

3.5

3.2

4.9

5.4

0.2

1.3

2

2

0.3

2.3

10.1

0

0

0.5

0

2.2

0

0

0

0

3.2

1.9

7.2

3.4

16.2

73.5

0.4

2.9

0.4

0

0.3

32.8

16.7

15.1

7.8

5.5

6

10.4

8.4

22.6

1.5

1.5

0

0

0

0

0

0

0

0

12.1

1.2

10.7

7

27.6

190.9

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1985 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	20.6	29.3	14.8	38.3	30.3	20.6	18.4
15	61.8	13.6	29.4	26.7	16.6	31.8	12.1
16	30.2	44.5	14.7	25.3	34.2	45.7	47.5
17	76.7	23.9	38.9	9.3	28.2	45	69
18	87	90.1	17.8	91.9	37.2	25.5	37.8
19	5.1	0	0	0	13.9	0	0.7
20	0	0	0	0	0	0	0
21	0	0	0	6.2	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	24.6	18.1	5.9	11.5	7.1	13.9	0.6
15	16.9	30.8	71.3	10	18	27.6	27.1
16	47.3	19.9	11.4	35.5	37.7	38.8	
17	23.5	143.1	41.4	92.2	124.7	47	92.6
18	18.2	5.1	3.3	3.5	3.4	0	36.2
19	11.1	0	0	0	0	0.9	0
20	11.7	0	6.5	0.8	0	0	0
21	0.4	0.5	0	0	0	0	0.5
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Total	464.9 264.2 345.3 354.4 269.7 458.6 318.9

2010

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1985 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2011

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1986 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2012

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1986 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 0.9 0 0 3.3 3.8

2013

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1986 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.1 0 0 2 3 0 3.1 8.6 0.7 16.2 6.9 1.5 1.5 1.9 1.4 2.2 0.2 3.5 3.8 0 8.8 0.7 4.3 5.1 1.3 0 0.6 4.1 0 1.6 4.5 7.3 0.3 5.4 1.7 3.3 1.1 15.4 0.7 24.1 0 0 0 0 0 12.8 0 0.1 0.8 0.6 4 6.1 5.9 6 1.1 1.1 1.4 1.7 5.1 0.3 5 4.1 2.3 4.5 9.3 2.3 1.4 22.1 13.5 1.2 11.7 8.1 2.3 1.4 4 1.5 0. 7.8 0.2 0.6 2.9 0.9 1.8 7.5 3.6 0.6 14 1.9 0.6 9.2 0.7 8 10.6 6.8 6.6 15 8.8 27.5 11.8 2.8 71.6 39.4 7 60.6 38.6 95.4 107.5 91.2 94.1 14.1 110.9 30 89.5 88.8 73.1 47.7 105.9 67.9 57.1 48.3 100.4 50. 47.8 104.1 77.6 36.7 54.8 91.5 54.8 55.1 80.2 55.6 52.8 49.4 98.3 89.2 41 68.8 39.2 63.8 20.6 67.8 71.4 28.1 53.1 52.8 66.2 52.8 70.2 62 51.6 91.8 40 50.1 25.3 20.6 62.8 24.1 71.7 31.5 49 16.1 14.9 31.8 32.8 57.9 24.7 40.4 22.2 13.7 32.8 45.6 41.7 10.4 34.4 15.7 34.1 30.4 37.1 29.6 38.7 4.7 12.5 75 35.5 33 40.7 56.5 6.9 41.7 85.5 21.5 51.5 80.5 56.7 61.2 105.3 96.1 36.5 56.1 50.4 31.7 32.9 59.6 6 26.6 117.9						

Total	837.2 751.4 656.9 983.2 1042.2 693.5 1083.6

2014

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1986 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.5	13.3	4.7	27.8	4.8	14.3	1.1 30.6 13.6 24.1 10.9 6.8 25.3 1.4
13	60.1	37.5	29.7	30.4	12.1	50.3	3.2 94.1 76.8 75.8 75.2 49.9 74.8
14	78.2	147.9	92.1	92.2	166.6	105.8	51.3 31.5 80.8 120.5 49 46.1
15	105.2	34.1	19.2	65.1	143.9	64.4	96.7 146.9 39.8 29.4 59.1 131.8
16	20.6	138.6	145	34.6	60.3	57.1	109.3 7.1 48.7 90 11.2 38.5 56.8
17	136.8	24.8	48.6	89.9	20.1	95.6	49.7 88.8 34.6 45.1 96.9 39.1 100
18	69.3	63	53.3	59.5	51	18.8	67.4 29.1 97.2 17 44.4 46.1 5.2 39.4
19	37.4	69.8	15.2	14.4	26.5	6.7	27.3 11.1 23.7 4.1 10.3 17.1 9.8 22.3
20	30.8	4.8	5.1	15.9	16.5	0.5	20.2 0.8 2.8 1.5 14.8 19.2 0.3 17.9 1.9
21	6.7	3.2	7.7	23.6	2.3	11.6	1.1 12.2 1.6 1.5 9.1 1.3 9.1 19.1 11.9 0.6
22	3.7	12.2	0.5	11.5	8.7	16.9	4.1 15.6 18.9 2.9 15.8 2.1 8.8 1.7 7.6
23	12.6	0.3	16.6	0.7	5.6	0.2	2.6 4.6 0.5 0.2 0 2.3 0 3.2 5.6 0.2 1.2 0
24	0.2	0	0	0.6	0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 1.7 0.1 2.6 0 0 0
25	0.3	0.4	0	0.3	0	0	0 0.5 0.8 0 0.6 0 0 0 0 0 0 0
26 27 28 29 30 31							

Total	926.9 1290.3 534.6 938.4 1118.3 446.8 720.7

2015

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO

Year - 1986 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0.7	6.9	0	0	0	0.2	1.1
16	17.9	0	0.7	0	0.1	0.5	0
17	0.2	0	0	27.7	0	0	0
18	0	0	1.5	0	0	0	0
19	0	0	0	0	0	0.2	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	2.7	0	0.7	1	3.7	0.7	0.1
23 24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	1.7	4.3	0	0	1.7	0	0
16	30.2	0	0	0	0	0	0
17	3.9	0	0	0	0	0	0
18	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	12.3	0.2	4.5	0.1	22.4	4.6	0
22	0.2	0.5	0.1	2.6	1.7	19.4	10.3

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0.1	5.5	0	2.1	5.1	0.5	7.5
16	0	0	0	4	0	0	0.2
17	0	0	0	3.3	0	0	0
18	0.7	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	1.1	0
21	0	0.7	0	0	0	13.8	0
22	0.7	0.1	2.6	1.7	19.4	10.3	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

Total	6.3 150.8 20.5 37.8 22.4 8 55

2016

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1986 : M o nth - De c ember

Year - 1987 : Month - January

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1987 : Month - February							Y
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 0 0 0 0 0 0.8

2018

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1987 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 5.1 0 0 0 0 0 2.2 0 0 0 0 3.9 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	5.1 0 0 0 3.9 0 3.2

2019

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1987 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	5.6	5.3	0	2.3	0	0	2.3
12	2.5	17.5	32.5	14.6	3.2	17.7	6.4
13	38.1	22.7	101.2	42.8	23.9	49.8	19.2
14	14.3	55.7	21.3	68.2	46.1	53.3	46.6
15	31.1	30.7	41	40	33.9	86.7	43.7
16	65.3	39.8	15.3	23.7	78.2	50.7	26.8
17	31.2	51.7	31.5	22.5	16.5	77.4	79.6
18	21.4	19.7	12.5	29.5	65.9	37.2	37.1
19	107.2	45.9	22.2	53	7.9	16.9	5.4
20	26.9	20.6	5.7	17.5	27.5	39.2	14.3
21	5.4	28.6	4.3	3.5	0.7	0.9	1
22	2.4	3.6	2	2.7	17.6	7.9	1.4
23	3.3	6.8	0.6	5.6	3.6	4	2.2
24	38.1	140.9	23.3	12.3	174.3	9	179.4
25							
26							
27							
28							
29							
30							

Total	775.5 670.5 1120.7 957.9 593.3 1229.9 591.8

2020

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1987 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	15.2	14.5	7.1	26.4	11.4	22.8	9.8
12	14.9	11.5	5.8	13.2	8.7	15.4	7.2
13	4.2	37.5	22.9	5.5	24.9	7.1	21.9
14	44.3	17.3	15.6	32.1	11.9	19.9	23
15	15.9	23.7	15.2	38	6.6	32.5	18.9
16	35.2	18.9	12.9	21	9.9	23.5	31.5
17	22.2	36.6	33.1	49.9	106	13.5	52.6
18	54.6	39.1	32	31.7	17.4	35.5	33.5
19	35.5	49.5	45.4	38.6	56.1	42.6	36.2
20	68.2	21.3	25.5	38.4	44.2	7.2	31.8
21	86.4	22.1	50.8	29.8	21.9	15	10.5
22	40.6	19.6	33	35.7	25.4	61.7	30.9
23	26.6	53.5	15.9	52.7	78.6	14.1	51
24	8.1	44.8	7.5	21.5	24.8	4.5	19.1
25	4.1	4.8	17.1	3.9	23.8	5.6	22.8
26	13.4	1.8	3.3				
27							
28							
29							
30							
31							

Total	771.3 1084.1 637.6 924.2 772.3 726.8 780.5

2021

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1987 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	42.8 14.2 11.8 2.8 2 18.6 0.4 27.5 10.3 36.2 71.7 58 31.8 55.1 32. 4 26.4 61.6 13.8 37 35.9 28.7 4 35.2 20.5 7.2 57.9 24 36.5 13.1 37.6 32.8 11.6 14.2 20 1.6 5.2 2 1.6 6.2 4.3 7 1.3 9.5 0 0.5 0.3 0 2 0 3.2 0 1.1 8.7 0 19.1 1.9 9.4 0 2.8 9.2 14.1 41.4 11.1 2.1 0 47 0 0 9.2 0.1 1 0 0 0 0 0 7.2 5 0 0.5 0 0 9.1 6.6 10.1 0.2 0.5 0.5 0 0.4 7. 4.6 21.2 7.9 3.1 12.4 0.8 1.3 1.2 0.9 1 0 0.5 2.5 2.1 1.7 0 0 0 0 1.1 4 2.6 3.1 3 0 0.4 1.6 0.3 2.4 0.4 0 0 1.1 2.2 0.7 10.5 0.3 0.2 0 0.2 44.2 9.3 0 0 0 0 1.4 7.3 23 0.7 2.3 19.2 9.3 0.9 7.6 18.6 0.4 20.1 20.7 6.6 1.1 0 10.2 7.3 25.1 9.9 3.4 28.3 4.5 3 3.9 6.8 7.3 7.5 0.6 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	277.6 178.9 187.6 309.8 177.7 219.3 271.9

2022

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1987 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.8 1 0.8 0 2.5 0 0 0 0 0.1 0 2.2 0 0 0 1.1 0 0 0 0 0 8.5 2.6 0 0 1.5 0 0 5.4 0						

Total	3.5 0 4.7 1.5 0 1.8 16.3

2023

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

2024

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8.1 6.4 0 0 0 0 0 0 0 0 10.5 0 0 1 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6 4.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0 0 0 0 0 0 0 3.5 0 0 0 2.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	6.4 4.6 10.5 0 0 7 15.4

2025

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	16.4 0 0.9 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1. 0.7 0 0 0 2.9 22 5.6 0.5 2.1 3.1 0.2 9.4 1.3 12.9 8.7 10.8 27.2 31.7 3.2 7.5 10.4 18.3 31.2 17 20.8 4.9 37.1 17 4.9 24 13.7 12 6.5 64.3 18.4 10.9 40.5 21.5 22.8 4.1 9.2 32.5 27.2 16.3 38.2 2.7 2 11 23.1 14.4 11.2 17.4 31.2 18.9 25 54.5 51.6 29.3 68.3 9.7 12.6 44.8 39. 23.6 54.6 39.7 35 20.1 68.6 45.3 46.1 53.1 41.8 18.9 17.2 7.1 19. 39.7 9.5 17.2 13.1 12.8 7 11.3 20.1 3.3 7.7 10.5 6.7 10.1 7.9 15.5 5.9 5.2 10.4 7.1 5.5 6.6 8.5 4.4 5.2 12.6 9.7 10.8 21.2 20.2 15.6 12.5 11.2 17.1 25.8 31.7 29.1 29.1 12.4 23.4 14.6 41.7 43.8 33.2 37.6 23 23.4 19.3 4.6 53.4 32.7 16.3 22.3 31.4 33.3 39.1 58.7 41. 59.2 55.8 35.8 27.2 15.8 39.2 38.5 30.8 26.1 71.7 22.8 20.4 75.9 85.5 34 81.8 19.6 20.9 10.2 44.4 36.1 14.6 43.8 18.4 11.9 45.9 30 19.5 43.9 26.2 16.3 5 31.7 18.8 17.8 12.4 7.7 17.6 7 23.6 11.1 16. 9.3 8.4						

Total	516.8 318.2 591 734.4 661.6 599 643.2

2026

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	36.8 40 7 97.4 55.5 5.9 59.1 59.9 88.5 9.7 164 88.1 17 95.7 63.1 165.9 21.5 217.9 165.2 50.9 163.9 65.5 129 52.9 239.2 180.4 66. 216.5 68.6 58.2 51.8 154.8 92.6 69.3 122.7 35.9 30.5 22.7 56.9 48.3 20 31.9 13.8 29.6 17.1 44.6 21.5 13.6 41.1 15.4 22.5 11.2 16 11.1 16.9 6.9 57.5 11.7 58.3 17.8 34.5 33 16.3 43.6 6.4 35.3 33.7 30.9 27.9 31.3 16.2 6.7 0.7 22.8 17.5 14.2 13.5 15.6 19 29 30 31. 21.7 25.5 9.9 1.4 2.1 2.7 1.7 7.6 2.7 3.6 6.6 0.4 1 2.1 4.6 1.4 12.6 17 72.6 9.9 10.7 8 1.3 69.5 20.1 6.9 23.2 19.2 9.8 26.4 53 74.4 79.7 24.1 30.9 49.5 30.1 54.6 134.8 69.9 34.4 25.7 47 35 112.8 36.7 97.6 42.7 28.9 52.6 42.4 66 29.2 48.4 34.4 26.4 16.5 43 35.8 35.7 12.3 50.9 44.3 19.3 48.6 13.8 10 3.2 33.9 18.9 7.8 28.8 11.1 2.3 33.8 33 5 25.9 14.8 17 6.3 32.4 17.6 14.5 25.3 32.7 8.4 23.2 30.5 20.1 22.8 17.8 1.9 1.9 0.7 12.6 4.4 3.1 8.9 2.5 7.3 15.3 8.9 1 2.3 6.2 17.2 14.3 4.2 3.6 3.9 0 3.8 23 5.8 21.3 6 3.9 14 7.6 7.7 1.6 28.8 4.2 7.1 7.9 2.8 1.1 1.6 8.9 8.4 9.2 7.7 7.6						

Total	1035.5 1038.8 821.3 1493 1086.8 656.9 1190

2027

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	16.7	0	2	1.1	1.9	0.3	0.3
16	38.6	7	32.2	0.7	5.1	30.3	13.1
17	0	0.1	2.2	0.7	13.4	0.2	0.1
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23							
24							
25							
26							
27							
28							
29							
30							
31							

48.1	0	5.3	0.8	5.3	13.2	4.1	0	2.1	10.4	24.3
1.4	6.8	22.4	4	0.2	2.4	4.4	6.8	7.7	6.4	
0	0	0	0	0	0	0	0.5	0	0	0
0	0	0	0	0	0	0	7.9	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1.5	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

Total	78.9 7.5 52.6 44.4 70.7 35.7 65.5

2028

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1988 : Month - December

<table>
<tr><th>Date</th><th>74°E
15°15'N</th><th>74°15'E
15°15'N</th><th>73°45'E
15°30'N</th><th>74°E
15°30'N</th><th>74°15'E
15°30'N</th><th>73°45'E
15°45'N</th><th>74°E
15°45</th></tr>
<tr><td>1 2
3 4
5 6
7 8
9 10
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31</td><td colspan="7">0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0 2.7 4.2 6.7 6.9 0 0 0 1.9 1.4 0 0.3 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0</td></tr>
</table>

Total	0 1.1 0 4.6 5.6 6.7 7.2

2029

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1989 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2030

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1989 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0.4	0	0.2
19	0.5	0	0	9.1	0	15.9	1.4
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	0.5 22.6 1.9 1.7 5.7 0.7 14.8

2031

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO

Year - 1989 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	0.7	10.2	0	0	14	0	5.9
12	19.6	10.3	1.1	1.9	14.3	3.7	0
13	0.5	96.2	13	18.4	141.4	117	84.1
14	131.6	177	86.3	79.5	148.4	51.8	63.6
15	49.8	28.2	58.5	44.3	71.6	65.8	48
16	41.7	45.4	13.5	40.1	56.3	23.2	45.5
17	51.4	26.6	46.2	9.9	41.4	72.7	13.7
18	24.3	112.2	53	40	19	59.2	47.1
19	21.6	33.8	21.7	11.7	52.4	28.6	9.6
20	11.7	13.8	7.8	9.2	2.2	2.3	9.2
21	61.6	36.7	41.7	7.9	84	53.1	109.7
22	60.8	24.6	7.6	11.7	26.3	14.2	14.4
23	15.9	23.4	13.7	13.5	9.8	12.4	15
24	31.4	18	20.6	64.6	67.5	15.2	63.3
25	69.7	81.5	53.4	65.2	87.2	75.2	28.5
26							
27							
28							
29							
30							

0.7	10.2	0	0	14	0	5.9	1.5	4.9	1.4	12.1	7.5	8.4	19.2	7.3	2.3	1	5.8	1.
19.6	10.3	1.1	1.9	14.3	3.7	0	6.3	20.4	0	0	0.4	0	0	0	0	45.2	56.1	4.2
0.5	96.2	13	18.4	141.4	117	84.1	181.3	87.2	65.3	92.2	107.9	82.8						
131.6	177	86.3	79.5	148.4	51.8	63.6	46.9	84.5	67.2	54	138.5	44.3						
49.8	28.2	58.5	44.3	71.6	65.8	48	37.3	44.6	29.9	34.9	34.4	39.3						
41.7	45.4	13.5	40.1	56.3	23.2	45.5	89.5	76.9	11.7	55.4	59.2	12.7						
51.4	26.6	46.2	9.9	41.4	72.7	13.7	39.7	32.3	33	14.3	100.2	65.9						
24.3	112.2	53	40	19	59.2	47.1	13.9	58.8	26	22.1	23.2	32.1	25.6					
21.6	33.8	21.7	11.7	52.4	28.6	9.6	21.3	18.6	16.9	7.4	12.9	8.9	6.5					
11.7	13.8	7.8	9.2	2.2	2.3	9.2	2.4	2.2	36.3	32.1	3.6	16.8	51.5	4.4				
61.6	36.7	41.7	7.9	84	53.1	109.7	82.3	36.5	37.2	46.1	78.9	22.1						
60.8	24.6	7.6	11.7	26.3	14.2	14.4	17.3	17.8	24.7	13.6	16.6	18.7						
15.9	23.4	13.7	13.5	9.8	12.4	15	14.3	16.2	16.8	31.4	28.7	14.7	24.					
31.4	18	20.6	64.6	67.5	15.2	63.3	60.1	31.7	38.4	68.8	78.4	19.9						
69.7	81.5	53.4	65.2	87.2	75.2	28.5	66.7	75.5	29.1	98.4								

Total	1172 1113.7 707 1373.4 1211.1 860.9 1373.8

2032

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1989 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	5.6	11.4	1.1	4.3	22 6	11.1	17.1
12	18.6	12.2	27	18.4	9.4	12.7	72.3
13	33.7	47.5	40.7	24.6	15.4	31.9	0.7
14	11.5	11.4	11.4	14.7	3.2	12.4	31.2
15	16.3	0.8	23.5	15.9	8.7	56.4	10
16	28.2	17.5	35.8	13.1	5.4	18.6	27.4
17	40.2	27.1	41.1	38.3	13.1	40	31.7
18	34.7	34.7	39	36.3	32.9	17.9	63
19	39.2	36.1	38.5	66.9	34.4	20.1	32.5
20	27.4	31.4	29.8	31.2	39.9	35.5	33.7
21	37.5	7.2	32.3	3.2	8.2	35.2	13.6
22	15.4	22.9	33.8	5.4	17.5	35.1	2.8
23	23.9	62.4	41.2	90.6	59.6	38.3	49.5
24	26.5	4.1	17.1	1.6	10.9	23.9	2.2
25	9.8	13.3	2.3	21.8	16.6	2.6	20.3
26	6.7	5.3	10.1	6.3	8	12.1	
27							
28							
29							
30							
31							

Total	797.5 807.2 674.2 845.4 816.4 470.5 874.4

2033

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1989 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.1 6.9 15.5 21.3 13.8 13.1 10.3 10.4 2.3 17.6 7.6 3.4 7.5 2.7 20 1.9 6 8 5.2 10.7 1.8 6.9 0.9 25.7 3.1 2.6 6 1.5 1.7 0.2 0.8 29.3 1.5 35.4 252.8 3.8 0 0 3.6 0 8.7 61.5 0 0 0 0 0 0.4 0 3.6 0.9 0 0 0 0.4 1.5 0.4 17.7 0.5 0 5.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2. 0.5 0 0 0 0 0 0 0.6 0 0 0.9 0 0 0 0 0 0 0 0 1.2 0 0 0 0 0 0 0 6.1 1.5 0 0 0 2.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 2 0 0.2 3.1 0 0.2 0 0.9 0 0.1 1.4 0 0.1 3.1 0 0 0.9 0 3.2 14.7						

Total	60.8 19.7 83.3 74.6 31.9 91.2 349.2

2034

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1989 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0.1 0 0 0 0 0.2 0 0 0.2 0 0						

Total	0 7.4 0.1 0 0.6 0 0

2035

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO							
Year - 1990 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2036

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1990 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0.1	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0.7	1.8		
22 23 24 25 26 27 28 29 30							

Total	0.1 0.3 0 0.1 2.7 1.4 3.9

2037

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO

Year - 1990 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	7.7 9.9 1.7 3.8 17.5 1.1 6.1 4.6 9.6 5.9 9 14.3 10.7 8.7 7.2 11.6 15						
12	16.6 12.6 25.1 11.1 31.5 6.2 22.8 23.9 16.7 37 6.8 22.8 0.6 43 13.						
13	5.8 28.2 7.6 1.7 0 2.8 0.4 0.3 2.4 0.2 5.5 10.8 5.4 7.3 2.2 7.6 1 27						
14	7.6 56.9 9.7 8.2 24.5 4.5 4.4 18.4 7.9 0.7 3.2 45.6 12.2 19.5 53.8						
15	27.5 16 8.1 29.9 3.8 152.4 29.3 56.3 53.9 46.2 50.8 12.3 86.2 40.						
16	32.4 108.6 68.2 51.5 55.3 14.2 26.9 13.1 25.5 11 16.9 11 31 31.7						
17	16.7 18.5 20.4 4 12.7 24 10 70.6 71.4 16.3 4.4 79.9 75.3 52.1 87.						
18	66 130.5 25.6 146 26.2 111.1 88.2 44.8 76.3 48.9 17.5 36.6 8.4 89						
19	113.3 18 83.2 17.1 16.4 6.7 20.8 49.8 6 52.2 11.6 7.6 1.6 16.3 31.						
20	18.6 44.6 5.1 6.9 2.3 7.9 30.6 7 18.6 22.6 10.6 35.5 23.5 13.7 16.						
21	6.3 18.7 20.8 16.2 31.8 27.7 21.1 22 25.8 26 32.1 33.6 23.2 21.4						
22	19.6 58.3 20.7 23.3 42.5 39.7 28.2 59.5 43.3 24.6 37.9 63.6 54.2						
23	33.2 42.5 36.7 35.4 11 32.5 54.4 48.1 52.1 44.5 69.8 4.8 34.5 54.5						
24	13.9 49.2 57.5 42.8 58.5 105.9 95.3 69.8 105.7 59.7 30 59.3 82.3						
25	90.3 32.5 54.2						
26 27 28 29 30							

Total	1072.7 730.5 768.1 1135.9 1093.6 908.8 833.2

2038

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1990 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	20.5	25.9	1.3	19.8	24.5	8	32.9
12	26.3	21.4	18.2	27.3	27.9	20.5	16.1
13	43.3	36.3	32.7	30.1	46.1	56.6	40.5
14	12.8	39.5	2.1	46.4	34.2	6.6	25.6
15	42.1	23	37.2	24.9	7	32.5	15.4
16	39.9	54.3	40	43.1	29.4	24	21.4
17	56.5	53.9	36.6	73.9	76.8	33.6	56.6
18	145.4	39.7	84.6	20.6	47.7	63.7	21.9
19	66	146.8	20.3	86	18	55.1	110.5
20	11.5	76.1	13.8	61.7	7	27.5	51.5
21	46.4	27	63.8	24.1	54.9	47.9	19.7
22	107.6	15.6	74.7	19.8	34.5	51.1	16.6
23	58.2	34.7	56.2	30.6	48	61.4	19.8
24	30.7	50.7	18.5	30.2	9.6	18.5	22.1
25	13.2	24.5	34.2	25.7	5.5	26.4	36.4
26	39.3	22.5	24.9	29.1	14.5	16	27.8
27							
28							
29							
30							
31							

Total	975.8 1560.8 679 1224.9 1407.6 770.1 1529.8

2039

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1990 : Month - O c tober

Year - 1990 : Mo n th - Nov e mber

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

0.4

0

18.1

0

18.1

37.6

9.8

16.2

6.8

0

0

0

0

0

7.4

23.1

0

0.2

0

0

0

0

2

3.6

6.1

32.7

34.7

10.7

46.3

5.3

5.7

284.8

0.3

6.1

0.2

0

0.5

0

0.6

3.5

2.6

0

0

0

0

0.9

1.4

0.8

0

0

0

0

0

0

0

5

25.6

15.3

45.4

10.1

2.3

3.7

5.9

130.2

3

1.5

0.8

0.1

0

0.7

0

1.6

0.9

0

0

0

0

0

0

0.6

0

0

0

0

0

0

0

15.4

20.7

16

19.1

0.7

3.7

0.4

0

85.2

4.9

3.3

3.5

2.4

0.5

0.2

0

2.9

32.1

0

0

0

0

0

0.2

5.1

0

0

0

0

0

0

0

12.3

22.4

26.8

35.4

47.1

20.7

0

0

219.8

2

3

18.1

13.3

0.8

0.4

0.4

21.8

4

0

0

0

0.1

0

0

0

0

0

0

0

0

0

0

0

4.7

24.6

11.7

36.3

33.5

13.4

0

4.2

192.3

9.9

0.7

2.3

0

0

0.9

2.2

3.7

4.5

0

0

0

0

0

0

0

0

0

0

0

0

0

0

7.7

19.7

7.6

14.5

17.8

3.1

0

0

94.6

1.9

2.2

0.7

3.9

0.6

0.3

0

1.6

10.5

0

0

0

0

0

3.1

0

0

0

0

0

0

0

0

0

43.2

22

25.5

17.5

42.1

1

0

0

176.1

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

2040

0

0

0

0

0

0

0

5.2

0.5

0.8

0

0

0

0

4.5

4.5

5.6

2.2

1.7

4.2

0

0

0

0

0

0

0

0

0

0

29.2

0

0

0

8.8

0

0.3

0.6

0.5

2.3

0

0

0

0

0

0

1.8

3.7

8.6

0.4

0.5

0

0.2

0

0

0

0

0

0

0

0

27.7

0

0

0

0

0

1.5

0.7

12.8

12.1

0

0

0

0

0

0

4.1

3.2

3.5

0

0

0

0

0

0.2

0

0

0

0

0

0

38.1

0

0

2.2

0

0

0

0

0

0

26.6

4.6

0

0

0

0

0

10.5

13.1

4.5

0.1

0

10.2

0

0

0

0

0

0

0

0

0

71.8

0

0

0

0

0

0

0

0.1

0.2

2

1

0

0

0

0

0

0

8.7

14.9

0

2.8

0.7

3

0

0

0

0

0

0

0

0

0

0

33.4

0

0

0

0

0

2

0.9

0.5

2.3

0

0

0

0

0

0

0

9.8

2.8

5.8

0

0.7

0

0.1

0

0

0

0

0.1

0

0

0

25

0

0

0

0

1.2

0

0

0.5

0

7

4.9

0

0

0

0

3.4

9.4

0

0.2

3.2

2.4

0.4

0

0

0

0

0

0.4

0

0

0

33

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1990 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2041

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1991 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2042

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1991 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0.2 0.5 0 0 0 0 2.2 0 0 15.8 0.6 0 0.2 7.2 0. 4 9.5 51.9 16.8 27.8 17 13.6 14.1 0 1.9 0 1.3 2.5 0.2 12.2 2.9 2 0 1.3 14.4 0 18.8 0 0 0 0 0 0 0 0.2 0 0 0.7 2 0 11.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 4.8 1.5 0 5.8 4.3 9.2 0 0 0 0 2 0 0.1 0 0 0 0.7 2.2 0 0.9 0 0 0.1 0.4 0.7 1 8.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0.5 0 0 0 0 0 0 0 0 0 0 0 0.8 0 0 0 0 0 0 0 0 1.1 0 0 0 0 0 0 0 0 1.5 0 0 0 0 0.1 0 0 0.5 0 0 0.3 0.3 0.7 0 0 0 0 0 0.7 2						

Total	33.2 59.7 16.9 38.2 56.3 19.7 84.7

2043

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1991 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1.8 1.4 3 1.2 1.9 4 1.5 9.9 4.8 12.3 14.3 15.2 10.4 24.2 20 30.8 21.8 16.4 1.9 17.7 8.6 29.4 10.6 1.1 4.3 6.9 11.5 13.7 23.1 34.6 5. 30.4 33.9 4.7 12.3 37.8 88.3 4 5.7 29.8 11.1 33.8 77.2 91.4 85.5 80.9 46.6 94.4 75 62 81.9 114.2 160.3 114.1 115.3 74.7 30.3 74.6 30.8 65.9 161.9 47.5 199.9 69.4 105 59.3 141.6 145.1 122.3 132. 39.5 119 7.4 106.3 100.7 13.3 37.7 36.5 45.5 0.7 15.3 60.3 26.1 35.7 7.5 12.6 0.7 9.3 9.4 0.8 7.3 1.2 0 0 0.3 0.3 0 1.3 0.1 0.8 0 0 0.4 0 0 1.2 1 0 0.2 1.2 0.8 0.6 2.9 4 1 0.9 1.6 0.4 0.2 13.9 11.5 1.1 4.5 6.1 5.8 3.1 19.2 14.9 7 14 15.6 2.9 7.7 22.1 20.9 26.8 21.2 35 10.4 22.1 29 14.2 4.2 32.5 32.9 21 21.7 16.8 15.7 3.6 12.2 11 8.7 5.5 6.5 2.3 0.6 0.3 22.7 0.8 3.8 14.8 12.2 22.7 6.8 14.9 11.2 6.1 13.3 11.3 7 6.7 10.4 11.2 5.4 20.4 12.4 18.4 14.2 9.3 17.4 6.7 13.7 54.4 22.2 14.5 34 6.8 2.2 20.3 39.3 14.2 25.3 24 24.1 12 4.2 24.9 9.4 31.2 29 13.4 17.7 28.4 23.2 6 0.7 1.9 6.7 6.4						

Total	672.4 963.5 490.2 837.4 978.5 620.7 779.6

2044

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1991 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	38.1	41	26.4	60.1	53.5	16.8	44.6 43.1 30.8 6.8 19.2 25.6 14.3 13.
12	26.2	26.4	18.9	17.4	30	13.4	17.6 14.5 19.8 8.6 20.9 24 11.2 7.3 2
13	28.6	19.7	14.4	15.1	6.2	7.3	28.1 33.6 23.9 42.9 46.9 31.4 10.7 45
14	35.2	25.9	33	21.7	27.9	13.8	70.4 34.7 53.9 52.3 21.7 26.7 25.6
15	38.7	23.6	11.5	25	34.6	10.6	44.5 17.8 25.1 2.2 13.4 32.6 2.8 26.7
16	34.4	44.7	6.1	33.4	36.1	11.5	33.2 36.8 39.2 14.1 37.3 60.1 13 44.
17	17.4	55.4	22	47.4	43.6	24.5	43.3 43.4 98.7 18.2 36.7 76.8 25.5
18	53.2	58.4	98.6	13.2	85.6	121.2	23.7 114.7 26.9 95.9 12.6 29.2 60.
19	25.9	63.8	50.3	84.1	17.6	65.5	75.5 44.3 67.9 20 73.8 13.3 43.8
20	42.5	21.7	62.9	29.7	65.6	17.5	34.6 46.6 27.2 49.8 21.6 64.3 6.6
21	26.5	38.4	14.3	46.6	12	67.1	8 36 48.2 20.7 49.8 27.8 58.3 21 32.8
22	38.5	24.4	37.2	26	61.3	13.1	34.6 45.4 17.5 36.9 20.2 53.1 10.8
23	35.8	55.2	21.9	75.2	8.3	36.1	7.8 28.3 33.2 8.5 39.6 5.9 20 11.5 15
24	25.2	9.1	21.8	6.8	19	3.6	13.4 10.9 1.1 22.4 13.9 25.7 7.1 13.4 8.5
25	5.6	18.7	13.1	19.6	1.9	13.7	19.2 8.8 30 3.8 13.3 3.2 16.2 12.6 6.9
26	15	7.4	8.2	6.5	8.6	12.4	2.7 18.2
27 28 29 30 31							

Total	831.5 1400.8 433.5 986.6 1216.7 520.1 1156.3

2045

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1991 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	1	2.4	0	18.4	7.6	9.3	28.8	0.4	0.7	2.6	2.8	13.4	0	12.5	0.2	0.1	0	1.4	
16	0	2.6	0	0.1	0.6	1.9	6.5	2.2	4.7	2.7	6.9	0	12.1	0.7	3.4	1	0.1	0	0	4.4	
17	0.2	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0	0	0	0	0	0	0.3	0	0	0	0	0	0	1.5	4	0
18	0	0	0	0	0	3.7	1	0	0	0	0	0	0.6	0	0	0	0.9	0	2.8	7	0	0	0	0	0	3.1	0	0	0	0
19	0	0	0	0	0	0	0.3	0	0	5.3	0	2	0	0	0	0	0	5.4	0	0.4	3.9	2.2	0.5	0.4	19	0	7.
20	11.2	1.4	3.8	3.8	1	3.1	1.7	7.2	0.2	1.6	7.2	6.7	0.1	0	0	0	0	0	2	0	0	0	(
21	0	0	7.4	0	0	4.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.8	0	0	0	0	0	0	0.4	0	0	0	1.4	0	0
23																															
24																															
25																															
26																															
27																															
28																															
29																															
30																															
31																															

Total	63.4 16.4 12.7 68.4 45.3 23.9 76.2

2046

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1991 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2047

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1992 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

2048

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1992 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0.7	0	0	12.3
20	0	0	0	0.7	0.4	0	0.1
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	2.4 19.4 0 2.6 4 0 20.6

2049

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1992 : Month - J une

Year - 1992 : M onth - J u ly

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

0

10

1.8

14.5

2.2

7.8

1

1.7

0

10.3

2.8

19.8

20.1

46.8

45.9

140.9

54.5

94.2

101.7

41.2

53.4

35.6

14.5

16.5

17.4

32.1

39.7

76.3

131.9

80.8

1115.4

0.5

0

1

0

2.7

8.8

0

0

0

0.1

16.1

12.7

40.8

50.9

39.7

33.1

14.7

6.4

42.5

74.8

82.9

65.9

32

12

30.9

45.5

51

58.5

96.9

113.7

934.1

0

0

3.7

0

42.5

21

0.5

0.1

0

3.2

2.8

16.6

0

14

19

294.4

162.6

20.9

113.9

27.3

12.2

31.2

27

15.1

2.8

3.6

28.8

30

45.1

63.9

1002.2

0

0

2

0

0.1

6.9

0

0

0

2.5

28.1

12.9

0

6.4

57.5

155

25.7

93.1

64.9

55.9

76.2

82.1

34.2

18.6

62.6

9

64

55.2

165.2

55.7

1133.8

1.1

0

12.3

0

3.8

5.4

0

0

0.4

3.3

17.3

9

0

9.6

7.6

38

6.5

8.3

10.5

27.7

135

85.8

63.9

13.9

48.2

33

52.3

11.7

78.9

15.8

699.3

0

0

4.6

0

1.2

1.8

0

0.3

0

3.3

14.7

4.7

1.2

9.7

19.5

202.6

180.7

28.4

64.7

56.6

44.9

51.1

19.3

51.9

23.1

12.2

29.1

35

45.6

87.7

993.9

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

962.6 Total

2050

0

0

7.9

0

0

6.2

0

0.9

0

1.9

8

15.1

5.2

15.3

19.5

12.9

9.2

13.6

17.1

54.1

156.9

123.1

97.1

46.9

31.5

29.2

37.1

53.5

124.8

75.6

71.3

18.4

0.4

0.5

0

0

0

49.1

20.6

5.3

28.5

40.6

18

60.3

53.2

33.1

62.3

86

49.6

97.8

123.8

107.3

20.2

30.1

18.5

29.3

44.1

9.9

18.3

23.8

14.8

1135.1

47.2

8.9

0.5

0

1.9

0

25.2

12.5

23.1

22.9

30.1

33.6

25.9

25.5

47.6

51.6

56.1

89.4

142.6

148.5

84.1

80.3

55.9

73.3

37.8

70

55

36.8

43.1

34.1

40.6

1404.1

81

11.9

0.1

0.2

0

0

0

10.2

31.1

7.7

5.2

17.4

20.6

69

21.5

50.1

54.1

36.1

20.2

56.1

54.6

59.3

15.6

28

19.1

18.3

19.2

12.6

5.5

6.5

4.8

736

95.7

6.1

1.5

0.2

0

0

1.2

33.5

10.8

44.8

35.7

6.3

6.1

31.9

30.2

29.3

66.4

98.3

41.8

138.3

101.5

135

36.7

48.3

34.8

109.5

52.7

36.5

23.9

25.2

22.3

1304.5

33.9

12.9

1.7

0

0

0

2.2

16.2

5.7

18.2

25.9

16.1

2.2

17.7

20

12.5

25.8

80.9

46.4

181.2

110.2

97.9

81.7

81

60.5

158.3

95

51.3

74.9

68.8

53

1452.1

50

3.9

0.8

0

0

0

0

0.2

33.8

18.1

5.2

28.4

26.3

31.8

23.9

44.9

63.4

59.7

43.9

36.5

55.2

59.2

26.4

37.5

26

66.3

31.8

15.3

12.3

12

16.8

829.6

26.2

9.1

0.5

0

0

0

1.4

12.7

9.9

7.3

72.2

19.3

23.4

21.2

29.4

9.3

28.7

67.9

99.6

159.9

116.7

123.9

82.1

56.2

40.2

184.3

100.3

64.7

64.7

41.1

38.2

1510.4

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1992 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	16.3 19.4 8.6 21.1 24.6 5.8 16.8 18.6 31.3 5.2 5.6 5.8 5.1 7.6 61						
12	56.7 38.5 46.6 30.2 40.5 34.6 99.1 29.4 51.7 83.8 26.1 78.3 20.2						
13	53.8 8.9 41.8 42.4 18.1 55.8 29.6 1.1 2.5 4.2 10.9 5.4 21.7 4.4 0.3						
14	3.1 0 0.5 1.1 0 5.2 0.6 8.3 3 37.8 0.7 3.8 0 10.8 21.3 19.1 13.3 9.3						
15	12.3 15.9 65.9 43.5 59.9 51.7 28.4 55.3 26.6 122.3 50.2 69.9 89.2						
16	61.3 64.1 95.2 34.7 59.8 9.5 67.1 120.6 44.5 131.2 40.7 79.7 39.6						
17	47.6 90.4 41.5 104.2 90.3 128 67.2 95.9 141.4 32 114.1 28.1 128						
18	22.4 54.7 105.2 25 181.6 57.7 58.4 32 76 79 50.5 61.6 42.8 57.3						
19	24 35.8 67.4 19.6 51.1 70.1 117.7 27.7 79.1 108.4 22.8 84.6 110.3						
20	64.9 28.4 76.7 112.8 55.5 46.4 23.9 43.1 9.7 35.1 81.7 12.2 87.6						
21	13.7 51.3 5.1 29.8 61.4 11.6 84.6 18.8 18.3 3.6 15.7 45 12.6 64.9						
22	8.7 13.2 8.3 8.1 41 6.3 29.4 6 6.1 16.9 6.8 6.5 24.8 9.6 7.2 8.5 5						
23	14.5 3.5 5.5 2.6 32.4 21.2 24.5 18.4 15.7 18.3 16.6 11.9 40.2 15						
24	12.4 21.2 18.5 9.1 45.9 45.8 17.1 53.9 68.7 15.1 77.5 29.7 85.4						
25	11.8 25.7 38.9 13 46.8 6.8 29.4 7.7 18.7 12.8 14.6 16.7 33.6 18						
26	33.6 19.9 12.1 27.4 10.1						
27 28 29 30 31							

Total	1163.1 1348.9 711 1194.8 1444.7 814 1486.4

2051

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1992 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	5.5	0	0.2	1.4	0.7	4.7
15	17	13.6	11.6	18.4	7.9	4	9.7
16	24.5	54.1	8.4	11.9	3.6	7.7	0
17	0	35.3	1.1	0	0.2	6.8	8.5
18	21.5	12.6	5.7	1.4	8.4	15.1	6.2
19	0.4	7.8	2.5	2	13.5	0.8	0.7
20	0	0	3.2	0	0	0	0
21	0	5.9	0	0	0	0	0
22	0	0	0	1.2	3.7	0	1.9
23	20.7	0	0.7	0	12.1	2.6	0.7
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	8	1.2	0	0.2	0.3	0	0.2
15	4	9.7	5.2	11	14.7	20.4	15.1
16	7.7	0	16.3	6.2	0	18.1	0
17	8.5	2.9	42.2	7.7	28.5	66.5	15.5
18	15.1	6.2	2.4	19.9	1.9	1.2	4.5
19	0.7	0.6	0.3	0.2	0.4	1.8	6.1
20	0	0	0	0	0	1.6	2.3
21	0	1.5	0	0	0	0	0
22	1.9	0	0	0	0	0	0
23	0.7	7.2	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	4.7	8	1.2	0	0.2	0.3
15	14.7	20.4	15.1	15.6	13.4	17.3	5
16	0	13.5	0	0	0	0	3.1
17	2.9	28.5	66.5	15.5	2.5	17.3	6
18	2.4	19.9	1.9	1.2	4.5	17.5	4.5
19	0.6	0.3	0.2	0.4	1.8	6.1	0.4
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0.7	7.2	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0.2	0.3	0	0.2	0	1.3	0
15	7.9	4	9.7	5.2	11	14.7	20.4
16	3.6	7.7	0	16.3	6.2	0	18.1
17	0.2	6.8	8.5	2.9	42.2	7.7	28.5
18	8.4	15.1	6.2	2.4	19.9	1.9	1.2
19	2	13.5	0.8	0.7	0.6	0.3	0.2
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	1.9	0	0	0	0	0	0
23	0	12.1	2.6	0.7	7.2	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0.7	4.7	8	1.2	0	0.2	0.3
15	4	9.7	5.2	11	14.7	20.4	15.1
16	0	16.3	6.2	0	18.1	0	13.5
17	42.2	7.7	28.5	66.5	15.5	2.5	17.3
18	6.2	2.4	19.9	1.9	1.2	4.5	17.5
19	0.3	0.2	0.4	1.8	6.1	0.4	0
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0.2	1.4	0.7	4.7	8	1.2	0
15	18.4	7.9	4	9.7	5.2	11	14.7
16	11.9	3.6	7.7	0	16.3	6.2	0
17	0	0.2	6.8	8.5	2.9	42.2	7.7
18	1.4	8.4	15.1	6.2	2.4	19.9	1.9
19	13.5	0.8	0.7	0.6	0.3	0.2	0.4
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	3.7	0	1.9	0	0	0	0
23	12.1	2.6	0.7	7.2	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	0.2	0	0.2	0	1.3	0
15	11.6	18.4	7.9	4	9.7	5.2	11
16	8.4	11.9	3.6	7.7	0	16.3	6.2
17	1.1	0	0.2	6.8	8.5	2.9	42.2
18	5.7	1.4	8.4	15.1	6.2	2.4	19.9
19	2.5	2	13.5	0.8	0.7	0.6	0.3
20	3.2	0	0	0	0	0	0
21	0	0	0	0	0	1.5	0
22	0	1.2	3.7	0	1.9	0	0
23	0	0.7	0	12.1	2.6	0.7	7.2

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	1.4	0.7	4.7	8	1.2	0	0.2
15	7.9	4	9.7	5.2	11	14.7	20.4
16	3.6	7.7	0	16.3	6.2	0	18.1
17	0.2	6.8	8.5	2.9	42.2	7.7	28.5
18	8.4	15.1	6.2	2.4	19.9	1.9	1.2
19	2	13.5	0.8	0.7	0.6	0.3	0.2
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	1.9	0	0	0	0	0	0
23	0.7	7.2	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0.3	0	0.2	0	1.3	0	1.3
15	14.7	20.4	15.1	15.6	13.4	17.3	5
16	0	18.1	0	13.5	0	0	0
17	2.9	42.2	7.7	28.5	66.5	15.5	2.5
18	2.4	19.9	1.9	1.2	4.5	17.5	4.5
19	0.6	0.3	0.2	0.4	1.8	6.1	0.4
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	4.7	8	1.2	0	0.2	0.3	0
15	9.7	5.2	11	14.7	20.4	15.1	15.6
16	7.7	0	16.3	6.2	0	18.1	0
17	2.9	42.2	7.7	28.5	66.5	15.5	2.5
18	6.2	2.4	19.9	1.9	1.2	4.5	17.5
19	0.3	0.2	0.4	1.8	6.1	0.4	0
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	5.5	0	0.2	1.4	0.7	4.7
15	17	13.6	11.6	18.4	7.9	4	9.7
16	24.5	54.1	8.4	11.9	3.6	7.7	0
17	0	35.3	1.1	0	0.2	6.8	8.5
18	21.5	12.6	5.7	1.4	8.4	15.1	6.2
19	0.4	7.8	2.5	2	13.5	0.8	0.7
20	0	0	3.2	0	0	0	0
21	0	5.9	0	0	0	0	0
22	0	0	0	1.2	3.7	0	1.9
23	20.7	0	0.7	0	12.1	2.6	0.7

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	4.7	8	1.2	0	0.2	0.3
15	14.7	20.4	15.1	15.6	13.4	17.3	5
16	0	13.5	0	0	0	0	3.1
17	2.9	28.5	66.5	15.5	2.5	17.3	6
18	2.4	19.9	1.9	1.2	4.5	17.5	4.5
19	0.6	0.3	0.2	0.4	1.8	6.1	0.4
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0.7	4.7	8	1.2	0	0.2	0.3
15	4	9.7	5.2	11	14.7	20.4	15.1
16	0	16.3	6.2	0	18.1	0	13.5
17	42.2	7.7	28.5	66.5	15.5	2.5	17.3
18	6.2	2.4	19.9	1.9	1.2	4.5	17.5
19	0.3	0.2	0.4	1.8	6.1	0.4	0
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	5.5	0	0.2	1.4	0.7	4.7
15	17	13.6	11.6	18.4	7.9	4	9.7
16	24.5	54.1	8.4	11.9	3.6	7.7	0
17	0	35.3	1.1	0	0.2	6.8	8.5
18	21.5	12.6	5.7	1.4	8.4	15.1	6.2
19	0.4	7.8	2.5	2	13.5	0.8	0.7
20	0	0	3.2	0	0	0	0
21	0	5.9	0	0	0	0	0
22	0	0	0	1.2	3.7	0	1.9
23	20.7	0	0.7	0	12.1	2.6	0.7

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	4.7	8	1.2	0	0.2	0.3
15	14.7	20.4	15.1	15.6	13.4	17.3	5
16	0	13.5	0	0	0	0	3.1
17	2.9	28.5	66.5	15.5	2.5	17.3	6
18	2.4	19.9	1.9	1.2	4.5	17.5	4.5
19	0.6	0.3	0.2	0.4	1.8	6.1	0.4
20	0	0	0	0	0	1.6	2.3
21	0	0	0	0	0	0.3	0
22	0	0	0	0	0	0	1.2
23	0	0	0	0	0	0	0

Total	97.5 110.2 66.5 201.9 164.9 108.6 209.6

2052

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1992 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2053

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1993 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2054

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1993 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0.4	0	0	0	0	0	0
17	0	0	0	0	0	1.5	0
18	0.2	0	0	0	0	6.3	0
19	0	0	0	1.2	0	0	0
20	0.9	0	0	0	0	0.5	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	0.5 10.5 0 0 11.8 0.3 10.6

2055

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1993 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0.3	0	0.1	3.7	0	0	12.8
13	3.8	13.5	2.8	0.3	15	13.5	6.5
14	5.8	0	3.3	6.5	1.8	10.1	2.2
15	9.1	1.5	5.1	16.8	6.1	3.2	17.7
16	32	36.7	24.5	19	27.4	28.3	18.8
17	40.1	92.2	125.3	62.2	48.6	82.2	23.4
18	111.1	133	90.6	120.8	104.1	94.5	95.8
19	112.3	21.8	103.3	26.3	99.4	91.7	34.3
20	80.7	48.3	172.3	9	11.8	1.7	21.8
21	12.7	7.3	7.9	0.2	6.1	21	3.9
22	4.4	4.6	3.3	2.3	3.2	8.9	4.3
23	56.6	28.8	13.5	17.7	35.4	22.8	17.4
24	7.7	2.3	4.3	7.1	5.4	3.5	8.1
25 26 27 28 29 30							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
12	0.7	0.6	0	0.8	0	0	0
13	0.3	17	2.4	0.9	0.2	0	2.4
14	7.8	5.7	7.2	19.9	8.2	5.8	8
15	17.7	5.8	30.3	28.2	25.9	47.3	22.6
16	18.8	40.3	57.2	51	38	39.1	50.7
17	82.2	23.4	66	38.2	142.2	38.7	50.8
18	94.5	95.8	73.1	71.3	30.7	93.8	93.1
19	91.7	34.3	111.4	33.5	81.9	16.4	104.6
20	1.7	21.8	24.1	4.8	26.1	6.9	5.5
21	21	3.9	2.3	4.1	6.2	0.1	6.1
22	10	12.8	8.9	8	22.7	32.9	6.8
23	13.5	17.7	35.4	22.8	17.4	34.9	13.8
24	4.3	7.1	5.4	3.5	8.1	1.3	11.4

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
12	0	0	0	0	0	0.7	12.6
13	0.3	17	2.4	0.9	0.2	0	2.4
14	7.8	5.7	7.2	19.9	8.2	5.8	8
15	17.7	5.8	30.3	28.2	25.9	47.3	22.6
16	18.8	40.3	57.2	51	38	39.1	50.7
17	82.2	23.4	66	38.2	142.2	38.7	50.8
18	94.5	95.8	73.1	71.3	30.7	93.8	93.1
19	91.7	34.3	111.4	33.5	81.9	16.4	104.6
20	1.7	21.8	24.1	4.8	26.1	6.9	5.5
21	21	3.9	2.3	4.1	6.2	0.1	6.1
22	10	12.8	8.9	8	22.7	32.9	6.8
23	13.5	17.7	35.4	22.8	17.4	34.9	13.8
24	4.3	7.1	5.4	3.5	8.1	1.3	11.4

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
12	0.8	0	0	0	0	0.7	12.6
13	0.3	17	2.4	0.9	0.2	0	2.4
14	7.8	5.7	7.2	19.9	8.2	5.8	8
15	17.7	5.8	30.3	28.2	25.9	47.3	22.6
16	18.8	40.3	57.2	51	38	39.1	50.7
17	82.2	23.4	66	38.2	142.2	38.7	50.8
18	94.5	95.8	73.1	71.3	30.7	93.8	93.1
19	91.7	34.3	111.4	33.5	81.9	16.4	104.6
20	1.7	21.8	24.1	4.8	26.1	6.9	5.5
21	21	3.9	2.3	4.1	6.2	0.1	6.1
22	10	12.8	8.9	8	22.7	32.9	6.8
23	13.5	17.7	35.4	22.8	17.4	34.9	13.8
24	4.3	7.1	5.4	3.5	8.1	1.3	11.4

Total	596.5 781.9 473.2 1014.7 770.8 537.8 1307.4

2056

Date

1

2

3

4

5

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7

8

9

10

11

12

13

14

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16

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18

19

20

21

22

23

24

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26

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28

29

30

31

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1993 : M onth - August

Year - 1 9 93 : Month - Sept e mber

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

39.5

38.7

20.7

6.4

7.6

2.3

2.2

2.3

10.4

7.3

28.7

58.2

97.6

56.9

47.2

44

20.9

13.5

14.9

21.7

20.9

8

1.7

6.3

21.5

29.5

5.2

0.7

1

6.5

4.1

646.4

56.3

64.7

38.5

25.3

18.2

3.1

3.7

6

8.9

31.5

60.2

98.9

73.3

56.8

77.5

50.6

29.5

25.3

24.2

25.1

33.9

16.1

9.9

7.5

35.3

25.8

7.1

4.5

1.5

5.8

6.7

931.7

16.2

37.7

28.6

0.5

15.4

7.8

2.9

5.5

3.5

7.9

26.4

41.9

24

18.3

8.2

22.8

12

9

4.3

2.5

1.8

6.8

1.5

1.8

4

19.2

1.1

4.2

1.1

5

5

346.9

46.7

38.3

55.8

4.9

22.3

4.5

2.7

6.8

11.6

21.5

44.6

116.4

64.1

85.4

55.9

57.8

51.4

48.8

51.5

30.4

19.7

19

6.9

14.6

24.5

33.9

1.7

0.5

2.6

13.3

2.4

960.5

68

68.4

53.5

23.1

25.1

3.3

1.9

7.3

17.5

28.3

98.1

155.8

52.3

64.6

89.1

69.8

49.1

28.8

36.3

35.1

34.4

19.1

10.5

21

36.7

21.8

7.5

4.4

5.3

6.6

3.7

1146.4

48.7

24.3

31.9

11.9

12.3

4.8

5.6

8.9

5

10.8

20.2

84.6

22.5

23.9

12.8

31.7

16.4

10.4

9.2

5.7

4.4

15.5

1.6

3.8

19.3

18.8

9.5

7

3.1

1.5

25.1

511.2

105.3

42

82.1

9.4

32.2

0.4

0.5

6.1

17.3

28.2

61.4

127.5

105.5

99.8

80.3

73.4

25.9

28.2

31.3

17.6

27.9

28.7

11.8

27.2

47.8

36.8

2.8

1.2

9

0

0.7

1168.3

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

5.4

1.4

6.1

12.1

22.6

31

12.8

9.7

12.1

17.8

13.4

3.2

3.4

5.2

0

0.2

0

0

0

0

4.7

9.6

7.2

15.5

18.8

27.3

12.3

0

0

251.8

4.9

5.9

11.9

23

32.5

29.2

15

6.7

4.4

5.9

6.5

2.1

3.9

11.2

0.1

2.4

0.8

0

0.2

0

0

4.3

5.5

6.1

12.2

28.4

14.5

1.4

1.2

1

241.2

4.9

4.5

9.4

12.7

32.5

8.3

4.1

8.5

10.7

12.6

12

3.3

16.3

2.5

6.1

0.8

0.2

0

0

0

0

0

0

3.1

15.2

30.5

6.3

7.3

0.4

0

212.2

5.6

8

5.5

14.7

29.1

47.2

29.8

28.8

14.3

35.4

12.5

6.4

17.8

13.4

4.7

3.3

1.7

0.6

0

0.2

1.4

2.2

2.2

4.3

27.1

54.8

19.3

10.9

2.3

6.3

409.8

1.5

5.2

12.5

17.4

32.5

45.3

23.7

17.6

15.6

20.5

9.1

2.4

6.5

6.7

0.7

3.6

1.1

0

0.6

2.5

0

4.7

7.4

3.4

14.6

21.2

18.6

4.8

0.5

1.6

301.8

3.7

11

19.4

34.3

25.2

16.9

12.8

8.8

24.8

13.4

3.7

7.9

20.1

17.5

0.8

4.2

1.8

1.8

2.1

0

0

0

1

14.3

20.5

13.5

17.5

7.4

3.7

0

308.1

4.4

5.3

8.5

12.5

34.5

65.3

31.6

36.8

8.2

35.9

24.2

10.2

21.8

20.6

6.1

2.7

0.6

0.3

0

0.6

4.9

3.3

2.3

4.1

20.6

23.6

16.5

22.8

0.5

21.7

450.4

2057

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1993 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	2.1 3.5 0.2 15.1 5.2 3.4 8.3 1.4 13.3 0 3.5 2 0 12.3 2 3.4 3.9 7.3 2						
14	7.5 25.3 5.6 11.3 19 50 13.3 5.8 16.1 4.3 38.9 0 2.7 7.1 14.3 3.3 2						
15	7.6 1.8 20.8 1.2 6.5 0.3 18.6 1.9 5 14.8 0 13.9 2.5 3.9 3.9 8 1.4 0						
16	10.4 4.3 49.1 18.2 36 12.4 9.8 24.8 19.9 21.4 7.1 12.3 22.9 19.6						
17	19.6 40 14.5 6.9 18 11.5 6.1 38.6 15.1 0.6 4.1 4.2 2.8 0.9 6.8 5.4						
18	0.1 3.8 0.1 2 9.4 0.9 7 8.8 1.8 0.6 5.4 2.5 3.5 22.6 0.6 5.5 11.1 1.8						
19	0.8 16.3 1.2 25.6 6.3 8.8 30.6 10.2 13.3 17.5 32.7 7.3 1.2 10.6 9.3						
20	4.1 5.2 5.6 17.1 11.7 17.8 16.2 49.1 64.4 1 1.8 0 5 0.4 0 13.2 21.1						
21	18.2 14.8 18.3 3.5 15.9 11.9 5 4.3 0 5.3 0.7 14.5 4.5 40.8 9.3 33.4						
22	22.7 0.6 15.4 1.8 0.3 1.3 0.3 0.8 1.6 0.3 2.5 12.8 5.9 0.2 9.1 2.3 0						
23	5.2 17 2.9 0.1 11.7 2.3 1.5 0.5 0 0.8 0 0 0 0 0.3 0 0 0 0 0 0.1 0						
24	0 0 0.3 0.7 3.3 0 0.6 0.5 0 4.6 0 0 0 0 0 0 0 0 0 0 0 0 0						
25							
26							
27							
28							
29							
30							
31							

Total	301.3 206.4 191.3 306.8 127.2 291.6 311

2058

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1993 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0.7 2.6 2.1 1.1 0.4 5.7 2.2 1.5 6.5 6.7 8.4 7.7 5.7 7.2 21.9 28.4 2.5 11.9 14.6 3.1 1.6 0 0.6 0.2 2.1 2.2 0.4 1.3 0						

Total	24.1 38.8 11.5 23.5 24.9 14.9 12.3

2059

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1994 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2060

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1994 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0.7 0 0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 2.9 0 0.2 0 2.5 0 0 0.8 0 0.2 0 0 0 0 2.5 0 0 0 0.4 0 0 0 0 2.1 0 0 0 5.5 0 0 23.8 0 0 1 2 1.2 1.3 5.6 0 4.9 2.1 6.8 10.4 2.3 16.5 4.8 15. 12.7 5.4 36.4 2 24.4 0 0.4 0.1 0 4.5 0 0.5 5.1 0.4 0 0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 0 0 0 3.1 0 10.5 0.1 0.4						

Total	9.9 30.5 15.9 19.7 72 5.7 73.7

2061

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1994 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 1.5 10.7 5.9 2.4 14.7 4.2 26.4 11.7 54.4 61.5 59 30.6 16.6 27.4 10.5 54 34.3 25 40.4 24.5 35.2 20.9 38.3 21.9 18.5 43.4 24.4 94 94.1 79.8 38.6 36.7 88.2 19.1 107.7 37.9 137.8 111.6 50.2 114 126.7 0.4 10.2 6.3 5 5.8 12.8 2.7 16.3 22 28.6 24.8 7.7 8.4 20.7 21.5 25.6 11 5.4 13.5 13.4 8.4 32.4 27.3 17.5 46.6 34.6 49.6 51 8. 15.4 20.5 19.3 19.6 18.7 10.1 58.6 35.4 62.5 25 58 65 28.8 72.3 39.6 80.7 91.1 61.6 45.5 63.3 38.6 118.9 22 79.2 65.2 44.4 37.7 68.7 133.7 18.7 62.2 77.2 24.4 39.9 48.7 47.4 16.4 63.1 91.4 18.8 103.5 23.1 43 2.6 57 39.7 9.5 99.7 64 25 10.1 72.5 35.9 48.4 69.2 16.9 13.4 6.1 16.7 18.1 16.5 28.9 8.7 11.2 7.2 13.7 33.1 10.2 17.7 0.9 18.1 8.8 12.6 4.8 1.2 3.2 6.6 18.5 1.8 10.3 12.1 7.4 12.3 12.5 12.6 6.8 20.6 23.6 4.1 21.1 8.7 20.7 1.9 25.4 45.2 2.9 12.1 22.5 69.6 15.8 89.4 67 28.9 86.1 48.6 38.8 26.4 25.9 43.4 17.1 23.2 34.4 38.9 7.6 55.7 51.9 13.9 71.3 13.2 67.8 8.2 53.2 88.8 22.1 82 41.3 166.8 30.9 108.6 152.3 33 152 70.7 171 43.1 166.2 199.8 127.5 215.7						

Total	1028.9 1367.5 836.5 1423.3 1442.1 975 1476.5

2062

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1994 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	21.4	40.9	12.2	33.8	44	7	41.7
12	52.4	19.2	37.4	55.4	19.5	55.9	21.9
13	24.6	4.5	17.5	14.5	5	21.5	1.4
14	10.8	4.6	7.5	5.8	13.8	2	9.7
15	3.8	2.8	5.9	17.7	3	4.9	10.6
16	23.9	91.8	92.4	43.8	115.7	47.6	129.6
17	17.1	10.2	24.5	37.3	11.2	37.7	8.2
18	15.1	2.5	7.2	15.8	2.1	6.5	41.1
19	72.7	30.6	54	51.4	26.4	38	90.3
20	66.5	52.7	102.4	56.9	47.1	77.3	41.7
21	31.9	41.3	7	21.6	20.7	14.7	17.5
22	119.9	100.8	82.9	91.2	62.4	67.1	53.9
23	41.2	44.8	82.5	11.2	56.5	87.7	21.9
24	19.1	108.9	69.4	78.5	30.8	128.8	95.1
25	96.8	52.4	103.5	13.8	59.9	8	44.5
26	72.1	84.1	47	79.9			
27							
28							
29							
30							
31							

Total	950.1 1601 614.4 1422.9 1440.3 606.4 1460.4

2063

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1994 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	12.7 9.4 0 4.9 0.8 0 13.2 15.5 20.3 4.1 9.3 13.5 17.7 5.1 7.7 21 3.						
14	4.8 13.9 11.6 9.3 6.5 5.3 6 36.6 15.2 10.2 24.9 24.3 12.1 3.1 7.7 9						
15	11.1 11.7 48.8 4.6 1.9 12.3 9.5 11.4 27.6 0 10.1 1.2 0 0 1.5 0 1.4						
16	24.8 11.5 7.3 0 18.6 0 1.9 27.6 0 0 6.5 0 0 2.4 0.3 6.4 4.1 2.6 0.6 (						
17	4.3 2.8 0.2 0 5.8 4.2 0 9.7 5.6 12.8 2.8 0 15.6 0 18.4 5.9 73.2 20.6						
18	0 104.4 3.7 0.4 13.6 6.6 4.1 20.2 2 9.1 17.5 4.3 7.9 1.5 7.7 10.3 4						
19	0 3.1 1 5.3 1 0.4 2 0 4.5 0 4.4 4.7 1.1 13.6 1.5 4.3 0 0 0 0 0 28.4 (						
20	0 1.1 8 0 3.7 14.9 14.8 100.7 13.4 23.7 27.1 16.6 2.2 2.1 3.1 3 0.4						
21	1.2 3.9 0 26.1 0 1.4 7 0.8 4.9 10 7.7 2.4 6.5 12.3 2.5 8 4.2 1.7 9.4						
22	7.2 0.6 3.3 6.8 21.7 9.2 0 0.7 7.3 0 2.5 8.1 13.1 1.5 11.2 12.7 15.3						
23	34 6.2 22.3 0 2.6 10.5 18.3 3.6 2.3 0 0.2 1.8 0.6 0 1.7 0.4 2.5 4.7						
24	8.6 4.5 4.9 22.2 2.6 1.6 4.2 11.9 3.5 18.6 0.9 0 0 0 0 0 0 0						
25							
26							
27							
28							
29							
30							
31							

Total	274 280.7 265.2 195.1 202.3 312.7 233.3

2064

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1994 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0						

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1995 : Month - Fe b ruary

Year - 1995 : M o nth - M a rch

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DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1995 : Month - June							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0.1 0 3.5 4.5 0 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 1.6 1.7 0 1.5 4.2 0 0.2 0.7 7.4 1 0.9 8.8 1.7 0.3 20 44.4 13 6.3 17.9 3. 6.3 67.1 44.6 28 50.2 37.2 45.2 25.2 81.3 47.3 166.4 130.4 30.2 93.4 58.2 47.8 21.5 57.7 74.8 11 49.2 22.8 43.4 38.4 28.1 14.5 34 14.2 12.1 14.2 28.6 33.6 20.4 17.8 43.1 14 37.1 27.9 37.1 28.9 12.7 34.9 20.6 25.9 15.7 25.2 17.3 4.2 52.2 20.9 6.6 8 2 29.7 21. 4.4 11.3 8.5 19 8.2 32.1 10.1 36.9 30.7 56.1 25.6 57.3 52 19.2 26 15.9 29 10 84.6 15.3 20.5 63.7 6.6 9.9 6.4 2.8 11.4 13.4 2.7 2.8 3. 13.7 1.9 6 14 13.7 5.2 4.7 20.5 4.1 3.8 12.6 10.9 5 13.5 24 29.1 4 10.5 14.4 5.9 13.4 30.9 49.8 15.7 12.4 24.5 4.7 48.2 27.5 19.9 13 7.5 10.1 10.2 117.2 30.2 125.8 23.6 24.8 100 36.7						

Total	649.8 493.9 779.2 557.6 344.4 644.6 318.9

2068

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1995 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	81.6	35.4	192.1	86.2	37	149.9	33
13	42.2	50.8	38.6	81.3	82.6	29.4	85.4
14	20.9	37.2	7.8	19.6	27.3	4.9	20
15	10.6	24.3	3.6	10.4	14.3	8.6	11
16	19.5	49.1	7.7	15.8	28.1	10.1	32.6
17	27.9	4.5	12.7	11.5	3.4	24.9	3.2
18	14.7	7.4	9.8	4.1	15.3	4.2	34.6
19	6.9	5.5	9	1.1	3.8	7.1	14.4
20	5.7	1.3	0	2.6	0.3	1.7	2.2
21	1.1	0.2	0	2.6	0	0	0.4
22	1.8	0.4	6.3	2.5	0.4	1.6	29.3
23	37.7	17.8	59.3	27.9	35.5	27.3	44.2
24	43.4	40.9	49.7	54.1	40.8	86.1	58.8
25	73.9	98.1	132.8	102.5	124.3	104.5	
26							
27							
28							
29							
30							
31							

Total	761.4 742.2 767.3 796.2 774.9 878.9 683.7

2069

AILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MO

Year - 1995 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	18.4 3.8 0.8 2.9 13.1 11.5 5.4 5.2 1.9 0.4 0.7 9.1 0 3 2 0.4 0 0 0 1. 3.1 7.8 9.9 3.9 15.2 34.4 7.9 6.8 7.8 2.2 0.7 9.6 8.9 6.9 27 24.4 4. 0 0 10.3 1.5 4.7 0 0 0 0 0 0 0 0 0.7 0 0 0 2.3 0 0 2.1 0 0.7 0.7 0 2. 19 0 10.6 11.1 11.2 1.5 3 19.2 7.6 10.9 10.6 14.9 44.7 16 14.6 4.3 37.3 14.2 15.5 64.1 15.5 14.5 8.9 31.5 15.7 1.9 25.1 0.9 0.4 2.9 1 3.3 14.9 8.4 0.9 0 0 0 0 0 0 0 0 4 0 0 0 0 0 0 2 0 0 3 0 0 158.3 37. 36.2 49.9 34.3 10 17.8 7.4 8 75.5 11.3 4 57.7 9.6 26.1 7.7 9.2 13. 12 4.6 8.9 0 1.1 0 0 0 0 0 0 8.5 0 0 0 0 0 18.5 10.4 17.4 21.5 10.3 8.1 18.1 24.3 26.9 6.9 23.1 23.3 15.4 4.3 0.2 0 0 0.2 0 0 1.1 0 1.8 1.3 2.1 0 2.5 0 0.2 0 3.4 0.8 5.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	368.1 156.8 253.3 208.2 224.7 276.2 151.1

2070

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1995 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2071

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1996 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0.1	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21							
22							
23							
24							
25							
26							
27							
28							
29							

Total	0 0.1 0 0 0 0 0

2072

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1996 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0.4 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0						
17	0 0 0.6 0 0 0 0 0 0 0 0 0 0 0 2.8 0 0 0 0 0 0 1.5 0 0 3.4 0 0 8.9 0						
18	0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.8 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	4.3 1.1 0.4 3.4 5.8 0 10.2

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1996 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.8 0						
13	0 0.2 0 0 2 8.1 2.3 2.3 0.4 7.8 16.1 7.8 13.2 5.6 29 9.3 0.5 0.1 0 0						
14	9.4 5.3 9.7 0.7 3.1 0.8 10.9 0 12.9 3.9 11.1 5.1 49.3 21.6 3.5 37.3						
15	0.6 27.4 12.2 107.3 9.6 25.5 109.1 2.5 2.5 37.1 6.2 11.7 20.5 31.7						
16	6.4 75.1 53.4 35.6 40.2 31.1 21.2 13.3 108.5 136.9 105.6 176.1						
17	40.5 88.3 16 223.4 121.9 376.8 180.2 149.8 327.7 16.7 95.8 117.8						
18	94.1 104.6 51.7 100.5 86.3 86.1 106.2 86.4 105.2 95.9 112.1 117.						
19	92 146.3 75.1 98.7 130.8 90.7 129.7 80.4 146.6 65.6 105.6 90.2						
20	73.2 199.4 58.6 52.9 54 28.8 61.8 66.9 118.4 20.9 18.5 8.8 21.3						
21	12.7 14.5 38.3 17.5 9.2 13.2 30.4 19.4 7.6 17.9 12.4 4.7 13.6 14.3						
22	9.8 13.6 17.9 8 6.3 4.3 6.8 10.2 2.3 13.8 8.1 2.4 1.9 1.5 3.7 12.7						
23	11.1 0 0 0 1 0 0.1 6 0 0.1 0.7 0.7 0.4 0.8 0 5.4 5 0 1.6 0.6 0.5 0 0						
24	3.7 0.4 7.1 3.5 1.5 1.6 2 6.6 0.4 9.5 4.5 2.5 3.4						
25 26 27 28 29 30							

Total	944.2 1012.2 1109.9 1014.2 783.7 1164.3 840.7

2074

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1996 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.6 25.9 5.1 35.3 40.3 9.8 32.3 17.5 52 4.7 23.7 58.6 10.5 40.5 16.8 30 3.3 24.6 42.8 8.4 33.8 22.4 50.6 3.8 25.5 46 10.8 42.6 12 25.3 7.7 34.3 33.3 15 24.9 22.2 26.9 16.2 44.9 44.2 14.9 28.1 31.3 36.8 19 57.4 35.9 9.8 24.7 24 31.4 14.5 20.1 42.2 9.8 24.9 10.3 31.4 1.6 19.9 30.9 15.6 73 5.9 30.8 3.9 18.5 17.9 10.3 46.1 14.6 36.5 4.2 12.9 14.7 7.2 35.4 10.8 47.8 5.3 22.1 24.3 18.3 23 76 93 35 31.6 26.3 33 27.8 7.8 24.9 2.2 13.5 14.7 2.3 20 3.7 20.6 1.3 24.3 12.7 1.8 15.3 2.7 20.7 6.1 19.1 18.2 10.3 36.6 21.1 26.3 9.2 19.9 8.3 11.1 18 6 29.1 11.2 6.7 7.5 19.3 11.8 6.5 11.3 43.6 7.7 4. 24.5 14.2 11.2 12.2 1.8 9.8 3.1 7.6 25.8 18.6 22.8 3.3 10.4 13.2 10.4 23.1 11.3 21.3 7.5 5.3 10.9 1.3 7.6 0 14 0 7.2 7.1 1.7 5.6 1.7 16.2 22.3 43 2.1 29.6 19.3 37.9 35.7 27.3 11.9 36.9 33.1 15.9 29.4 22.3 12.8 23.5 11.4 8 6.2 19.2 44 39.9 33.8 16.5 50.4 13.5 42 30.5 23 18.3 30.9 43.6 31.5 25.8 21.3 18.8 8.4 16.8 9.2 18.6 3.8 6.6 2.3 9.3 13.3 8.1 12.6 3.9 4.3 1 20.1 20.6 2.2 13.5						

Total	524.3 903.1 358.1 663 705.7 447.9 766.2

2075

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Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 1996 : Month - O c tober

Year - 1 9 96 : Month - November

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

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15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

2.4

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1.3

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3.9

43.8

41.3

4.8

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2

2.2

18.5

1.7

1.1

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264.5

24.5

61.4

96.9

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1996 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.9 0 0 0 0 0 0 0 0 0 0 0 0 0 3.1 0 0 0 0 1.2 7.5 0.3 6.2 0 0.4 0 8.6 10.7 1.6 0.6 0 0 0 3.7 2.1 2.5 0.2 0 0. 0.3 0 0 0.1 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	13.5 24.3 4.6 7 0 1.4 0.4

2077

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1997 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2078

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1997 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0.5
19	0.2	0.3	0	1.7	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0.5	0
22 23 24 25 26 27 28 29 30							

Total	8.7 0 0 5.8 21.9 0 20.9

2079

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1997 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0.1 0 3.4 0 0 0 0 0 0 7.1 0.5 0.1 0 0 0 0 0 0 0 0 0.8 0 7.7 4.1 0 1.3 0 0.7 0 0 0 0 3.1 0 15.2 0 0.5 14 0 3.7 7.1 0 1.9 0.3 0 1.7 0 7.7 0 0.7 7.5 0.4 0 2.1 0.2 4.3 11.3 7.4 22.5 5 3.7 4.7 13.2 0 13.8 15.2 18 18.8 5.7 35 7.3 7.5 24.6 12.3 5.9 10.9 27.8 7.8 13.7 19.6 17.1 13 6.6 13.1 7.1 5.2 11.3 14 1.4 19.1 0 9.9 8.3 4.9 5.9 12.8 19.7 24 14.5 13.6 14.5 15.7 22.1 25.3 71.9 20.8 8.1 32.1 12.7 7.1 10.1 14 49.1 10.8 25.1 28.6 58.4 24.5 70.5 55.5 22.3 74.2 22.7 58.8 43.2 101.4 65 49.2 96.4 59.1 80.5 35.9 59.4 75.4 50 82 80.7 17.9 17.6 57.1 43.4 27.7 68.8 59.6 13.3 21.6 129 54.7 24.9 75 35.5 48.7 35 47.1 24.2 46 60.5 71.8 19.3 51.9 6.2 40.7 101 16.6 72.1 20.4 53.7 10.5 94.5 91.6 13.4 80.9 50.1 71.7 22.4 141 87.8 27.7 113.3 109.4 103.6 45.5 162.5 147.6 85.3 152.6 80.8 78 23.9 208.4 98.2 53.2 154.5 196.2 147.2 147.4 146.7 210.9 151.7 206.3 158.3 79 169.8 92.3 86.3 150.5 155.4						

Total	1013 894.6 1090.3 1358.1 1166.9 1104.6 1403.2

2080

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1997 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	55.3	98.4	40.6	88.3	117.8	62.2	109.1
12	28.4	96.5	39.6	64.5	40.6	25.5	128.2
13	55.2	44.8	78.5	20.3	35.7	12.1	100
14	144.1	35.9	120.6	101.6	108.9	33.2	88.7
15	27	56.3	135.4	37.9	106.7	33.7	49.7
16	30.1	42.8	18.9	34.4	23.9	62.9	19.1
17	42.6	75.2	29.7	29.4	32.2	27.3	23.9
18	27.5	103.8	42.3	65.6	92.3	59.4	39.4
19	22.6	30.6	27.8	9.4	25.9	17.1	42.7
20	23.7	34.5	12.1	20.9	39.7	21.2	30.4
21	40.7	19.7	24.1	14.7	29.5	17.1	27.4
22	44.5	59.7	77.4	12.5	60.5	61.5	19.4
23	87.6	37.3	83	33.4	60.4	90.4	38.4
24	55.8	79.8	42.2	103.9	93.7	53.5	88.2
25	23.5	40.3	10.4	15	22.8	21.3	33.5
26	25.9	3.7	7.9	16.9	2.4	11.9	5.3
27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
11	23.8	92.8	113.4				
12	8.6	38	17.9	45.6			
13	14.7	75	73.9	72.6	46.1	14	
14	37.7	144.7	60.5	91.8			
15	38.8	73.7	13.6	2			
16	45.4	11	24.6	19.8	25.4	19	
17	140.5	43	37.8	57.7	49.9		
18	19	33.2	36.3	42.8	93.1	35.1	3
19	11.6	29.5	12.5	22.3	24.1		
20	20.9	32.3	11.8	39.8	20.6	19.2	
21	23.2	41.1	37	11	46.1	37.5	22.3
22	66.9	60.3	95	27.2	61.5	123	29
23	72.6	51	74	37.2	77.3	87	29.1 67
24	88.2	57	84	64.1	43	131.6	61.6 69.
25	33.5	8.7	28	4.3	10	6.1	11.8 17.3 11
26	21.2	20.6	10.3	18.4	19.9	25.6	
27 28 29 30 31							

Total	1207.5 1547.1 900.3 1710.9 2020 1080.2 1842.7

2081

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1997 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	9.6	14	6.9	46.7	10.1	7.9	23.7
15	12.7	0.7	4.4	16	1.9	0.8	0
16	2.1	0	0	0	0	0	3
17	1.2	0.5	0	0	0	0	4.6
18	0	11.3	0	0	0.9	5.6	1.3
19	0	0	0	0	0	0	0
20	18.6	0.2	2.7	0	0.9	19.2	4
21	0	13.3	0	11.7	5.3	0	13.4
22	0.6	2.9	1.8	25.8	3.2	9.1	0.5
23	2.4	0	3.8	0	0	17.4	
24 25 26 27 28 29 30 31							

Total	93.8 163.9 46.4 105.9 54.2 24.4 119.8

2082

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1997 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 10.7 0 0 0 0 0 0.4 4.7 7.2 61.9 3.8 41.1 13.1 28.6 35 60.8 4.4 29.1 47.4 40.3 23.3 3.6 0 6.9 0 0 4.3 0.3 2.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	53 59.8 68 73.2 32.9 88.5 57.7

2083

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1998 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2084

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1998 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	3.3	10.8	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	1.1	0	0				
22 23 24 25 26 27 28 29 30							

7.3	0	0	0	0	3.3	11.1	0	0	0	0	0	0.8	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4

Total	6.6 30 0 0.4 1.1 0 0

2085

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Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MONTH OF

Year - 1998 : Month - J une

Year - 1998 : M onth - J u ly

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

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1.7

21.8

52.7

42.9

12.4

10.8

1.7

2.3

11

1

4.8

16.1

17.1

41.4

86.4

26.5

18.3

24.2

44.5

103.3

80.9

119

208.5

949.3

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7.6

14.7

30.6

36.3

12.3

13.8

9.2

8.1

12.4

2.6

13.4

18.5

26.5

46.7

57.1

56.7

43.6

45.2

28.7

90.1

82.1

111.6

136.8

904.6

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2.8

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6.9

25.1

12.1

12.6

45.9

62.7

7.2

0.4

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13.4

5.7

9.1

187.3

3

55.8

117.5

25.4

19.9

46.4

48

90.5

148.7

19.3

59.1

1024.8

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19.2

4.3

9.8

73.4

51.9

13

10

2.3

4.3

5.3

1.7

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34.4

11.1

20

114.5

56.4

18.9

19.7

77.2

75.4

62.6

113.4

189.7

989.3

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1.1

2.9

6.6

19.3

59.1

36.2

18.6

9.3

2.8

2.3

10.1

0.4

2.7

23.9

15

20.4

81.4

31.3

11.7

16.6

64

60.5

45.5

89.6

96.9

728.2

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1.5

5.6

21.5

15.4

32.9

92.6

27.5

10.5

2.2

11.9

25.2

3.2

33.7

70.7

13.4

17.6

87

66.1

24.9

51.3

34.2

92

85.6

47.6

144.3

1018.4

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1.4

32.2

3.8

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64.6

56.1

11.1

6.8

3.6

6.8

4.5

0.3

8.3

37.4

12.8

8.6

83.2

36.3

14.4

28.8

71.8

58.2

68.4

93.7

154.8

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2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

875.9 Total

2086

192.3

159.6

162.1

90.7

49.1

109.3

90.2

95.4

117

87.4

27.2

57.8

29.8

6.8

3.7

9.2

6

1.3

1.7

4.9

7.8

11.5

11.9

10.8

18.6

34.3

50.9

39.9

70.8

67.5

74.7

1700.2

119.6

116.2

88.5

56.5

48.1

94.9

57.3

43.6

52.3

39.8

17.3

13.7

12.6

4.8

6.8

10.1

7.1

2

5.4

6.5

7.2

7.3

23.9

19.5

21.8

52.4

24.2

37.9

52.1

40.5

69.8

1159.7

19.1

5.7

5.4

13.8

15.1

17.9

19.3

8.7

12.1

4.2

1.7

1.7

2.4

5.2

0

6.7

3.3

0.1

0.6

0.1

15.8

4.9

2

271.9

35.1

27.6

52.9

67.5

71.6

58.3

22.9

773.6

148.3

122.3

132.5

110.9

104.9

135.2

96.9

93.6

129.4

58.4

30.5

47.3

36.1

19.3

10.6

4.2

11.1

2.8

7.8

9

28.9

9.9

10

29.4

31.7

46.6

38

67.7

30.9

29.7

36

1669.9

106

68.6

94.7

53.6

59.3

108.5

84.4

65.4

114.3

48.5

18.7

27.8

18

7.7

5.5

6.1

3.7

4.6

3.3

8.6

4.1

5.8

20.1

6.3

14.4

45.5

29.8

47.3

31.7

25.6

25.5

1163.4

94.2

49.3

24.4

9.1

30.9

56.1

25.8

46.3

14.7

6.2

1.5

1.4

2

2.2

2.8

9

7

2.8

2.8

18.8

48.1

11.4

8.1

92.9

73.2

29.8

185.2

84

53.2

53.6

19.9

1066.7

117.5

121.6

117.1

66

70.4

120.4

97.5

68

90.8

46.2

21.5

27.4

26.5

12.3

7

2.2

10.6

4.6

9.7

16.9

40.3

9.1

1.8

27.9

44.5

49

45.5

56.8

43.1

33.7

26.9

1432.8

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1998 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	78 43.5 19.9 31.7 44.7 20.7 35.8 14.9 18.7 8.4 36.6 14.6 4.7 15.1 18.1 7.9 10.6 7.9 4.4 10.3 7.3 26.4 28.8 9.3 13.5 15.5 9.8 11.9 23. 25.2 1.1 13.4 5.3 7.3 8.8 26 31.4 1.5 12.8 10 5.4 7.6 40.5 51.6 57 42 32.6 50.2 51.7 37.2 50.8 67.7 35.8 21.2 33.6 31 37.2 49.7 30.1 41.8 24.6 28.1 35.7 88.6 64.2 18.6 88.9 71.9 43.8 106.4 92.9 63.8 35.4 110.4 76.2 36.9 118.8 77 43.8 14.3 93.9 42.1 12.7 91.9 41 22.2 18.3 47.7 38 8.9 32.2 33.8 11.2 12.6 29 18.2 4.6 31.8 7.1 2.2 2.3 13.1 5 3.2 11.5 0.5 0.2 1.9 6.9 2.5 20.3 13.5 9.5 2.9 0.4 2.6 1. 0 3.3 3.1 7.6 0.3 8.9 3.1 0 3 1.9 3.2 0 10.3 5.6 5.5 1.7 24.5 7.3 36 64.3 9.4 7.8 54.7 25 4.3 14.9 50.3 17.8 18.5 53.1 23.2 6.7 2.8 19 11.4 10.8 27.6 4 7.6 0.2 28.2 3.1 17.9 29.4 23.8 24 0.4 24.5 8.7 11.8 7.7 37.4 53.5 5.5 20.3 16.1 13.5 7.8 44.1 74.8 43.7 69.2 68.6 44.5 75.7 72.2 61.7 33.1 59.1 50.4 46.8 66.1 49.3 45.4 18.5 28.5 19.5 69.4 31.8 42.5 48.4 19.9 21.1 37.8 19.4 22 28.1 29.7 24.8 12.4 23.1 17.7 11.2 17.3 19.4 6.8 8.5 13.9 19 12.9						

Total	1048.9 911.7 516.3 1052.6 716.4 603.1 1019

2087

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1998 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13	11.6	7.6	51.4	34.4	10.6	12.6	26.1 11.7 2.5 1.5 4.5 2 25.9 3.5 2.6 0
14	0	23	4.1	9.1	15.8	16.3	5.4 11.1 16.1 7.7 15.8 24.1 17.7 15.1 4.9
15	51.8	31.7	33.2	32.4	9.1	8.1	4.2 6 1.9 39.5 8.4 12.6 5.6 1.4 6.6 6.3
16	5.4	3.6	36.8	13.6	0.6	5.6	0.8 6.2 2.9 7.7 25.8 6.2 22.6 30.6 24.9
17	17.9	33.3	20.4	0.8	19.3	7.7	14.5 18.2 11.8 26.1 1.4 10.7 7.8 8.1
18	19.8	7.1	7.2	12.7	4.8	2.1	3 6.7 5.1 6 1 8.1 1.6 3.1 7.4 9.8 14.8 2.8
19	3.6	0.2	3.6	5.7	26.3	14.2	44.6 47.3 22.9 65.4 49.6 32.2 23 3.1 38.
20	17.6	4.1	27.1	16.7	13.5	9.6	21 9.6 7.5 19.5 16 14 1.2 3.7 3.3 3.4
21	2.5	7.2	5.5	2.2	0.5	0.4	1.7 0 2.2 7.2 0 0 0 0 0 1.9 6.4 0 0 0 0 0 1.7
22	0	0	0	2.7	0	2.2	7.4 0 1.2 0 0 2 1.1 3.6 0 0 0 0 0 0.7 0 0 0.1 0 0 0 1
23	0	8.2	1.8	0	5	5.4	27.5 0.5 13 2.8 0 19.7 37.8 28.5 5.5 14.4 13 6.2
24	22.1	5.9	0.8	5.5	7.8	1.1	21.5 13.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0
25							
26							
27							
28							
29							
30							
31							

Total	351.5 317.1 172.2 372.5 187.6 317.4 353.4

2088

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1998 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 0 0 0 0 0 0.3 0						

Total	0 0 0.5 0 0.3 0 0

2089

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1999 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 1.5 0						

Total	0 0 0 0 0 0.6 1.5

2090

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1999 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0						

Total	0 0 0 0 0 0 0

2091

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1999 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	2.4	19.7	6.5	6.4	7.7	8.7	1.9
12	38.5	10.2	12.5	34.1	21.1	29.7	13.2
13	44	0.4	1.4	26.4	1	0.8	7.1
14	1.5	3.4	0.9	2.4	0	6.8	62.2
15	12.4	83.1	14.5	154.1	65.9	174.2	101
16	364	194.7	90.5	299.2	64.4	46	55.8
17	32.4	53.1	33.7	24.8	41.3	19.2	24.8
18	59.7	48.9	29.4	33	49.1	30.7	30.2
19	16.5	66.2	24.3	41.7	33.8	18.7	49.1
20	80.6	43.1	59.3	33.2	63.8	105	50.8
21	14.8	72.3	23.3	21.5	16.2	36.3	38.7
22	45.1	22.8	98.6	57.5	27.9	88.8	190.8
23	86.1	47.9	55.5	73.5	72.2	22.2	21.3
24	14.7	54.1	39	30.9	63	25.4	32.5
25	6.3	15.3	28.7	18.3	5.6	18	1.8
26							
27							
28							
29							
30							

74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
4.4	6.4	7.3	6.4	3.9	18.8	

Total	1383.2 966.2 1595.8 1325.1 937.2 1581.1 1139

2092

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1999 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	13.8	25.8	5.1	12.3	15.4	7.1	14.2 5.6 24.3 3.9 12.5 16.7 8.1 22.3 3
13	24.5	7	19.1	23.9	3.6	56.4	38.4 75.3 32 67.6 62.2 19 68.5 54.2 46.(
14	13	25.7	47.4	25.2	44.9	35.8	41.9 8.2 27.7 55.2 15.7 53.7 29.9 39.3
15	11.8	29.9	63.8	20.9	80	14	38.9 10.4 28.1 54.3 13 54 9 16.9 4.3 28
16	33.4	20.4	58.2	12.6	29	5.8	25.3 60.2 9.5 70.5 19.4 31.5 11 20.6
17	42.4	9.2	28.4	5.2	13.4	3.4	10.7 16.6 5.9 15.1 7.6 6.9 1.7 4.2 10.4
18	6.1	16.1	7.8	11.1	3.2	5.7	22.6 5.1 13.8 1.8 5.9 3 3.8 3.1 3.9 7 4.1
19	9.6	5.2	13	4.7	3.2	12.9	0.4 25.6 0.3 24.1 7.6 6.9 3.7 1.5 15.2 0.5 0
20	2.9	2.9	0	0.2	6.4	0	0 10.8 0 0.2 1.3 2.5 0.6 1.1 2.6 1.1 10.6 13.5 5
21	1.8	4.1	3	5	5.3	8.2	6.1 13.7 3.5 5.6 1.6 1.9 7 3.2 0.4 2.1 2.5 1.6 3.3
22	3.1	3	2.6	1.1	7.9	0.8	3.4 11.4 10.1 4.2 27.6 11.1 1.4 8.3 21.8 18.5
23	2.4	24.1	27.1	8.5	38.7	3.5	14.6 3.5 36.5 16.4 7.5 14.6 40.6 14.8
24	19.2	15.2	24	16.6	13.7	20.3	14 13.8 10.1 10.8 15.2 17.2 3.1 7 5.6
25	14.9	5.3	9.8	8.8	2.5	6.2	4.5 13.1 8.9 7.8 7
26 27 28 29 30 31							

Total	401.2 593.4 202.1 512.2 678.8 262.6 752.9

2093

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 1999 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 0 0 21.8 6.9 0 23.1 0 0 0 0.3 2 1.4 5.5 7.2 2.3 23.6 32 1.2 30.6 1 8.6 7.2 51.7 23.7 19.5 22.7 38.2 16.7 23.6 23.2 5.5 8.1 9.9 18.1 48.9 32.8 7.1 23.7 8.9 20.6 39.3 45.1 53.4 19.8 70.7 54.9 14.6 57 3.7 7.2 2.9 15 18.1 1.1 33.6 3.4 4.5 4.3 10.4 12 5.4 16.2 0 1.1 6.2 0.6 0.6 9.4 7.5 6.1 1.4 2.2 0.8 2.4 0.2 5 0 6.3 0 0.5 2.2 0 1.6 4.3 0 1.1 5.7 0.4 11.4 25.3 11.1 1.1 5.1 2.1 2.7 14.3 31 17.1 0.2 1.4 3.9 8.9 18.7 14.8 2.3 0 5.9 2.3 0 5.5 17.1 6.3 24 5.9 26.8 1.7 2.6 11.4 18 5.3 5.7 2.4 13.1 27.3 4.6 2.3 0.1 11.8 1.4 0 1.1 0 0 0 0 0 0 0 0 2.1 3 0 0 3.8 0 0 0 0 0 0 0 0 0 3.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.6 4.2 0 0 0.3 0.9 6.6 1.5 18.6 6 7.4 0 0.5 0.4 0.8 8.1 30.8 0 0 13.7 0 1 0 12 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	298 210 175 257 188.4 151.4 374.1

2094

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 1999 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2095

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2000 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

2096

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2000 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	7.3	0	4.3	0	0.7	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	11.4	10.4	11.8	0	0	0	0
20	0.5	0.3	0	0.3	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	9.4 15.9 10.1 9.6 28.9 11 19

2097

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2000 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	40.1	4.1	36.5	24.9	7.5	35.1	6.8
12	1.7	7.5	4	4	2.3	51.2	7.5
13	16.9	83.6	14.2	92.7	60.1	100.2	58.8
14	25.4	50.6	73.8	41	49.3	95	75.2
15	62	61.3	45.2	79.8	65	79	43.4
16	125.2	82.6	34.3	82.6	54.8	161.8	143.1
17	58.3	47	34.7	72.3	46.2	44.4	92
18	32.4	7	12.1	41.4	12.4	31.8	14.4
19	2.5	11.6	44.9	2.4	31.7	5.9	22.8
20	16.8	21.3	53.3	17.7	33.8	15.7	90.1
21	10.8	9	0	1.3	2.5	2.9	1.5
22	0.7	0	7.6	3.3	0.6	2	1.4
23	13.2	24.5	27.6	5.8	0.7	7.3	5.5
24	16.7	18.3	48.9	23.3	52.4	89.6	11.4
25	6.7	46.9	27.1				
26							
27							
28							
29							
30							

Total	1401.3 881.6 1115.1 1291.6 722.8 1119.8 818.1

2098

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2000 : Month - August							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	 0.3 0 2.1 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 3.7 0 1 0 0 0 0 0 0 0 0 0 2.7 0 0 5.9 4.5 6.5 0.4 3.6 14.7 1.8 7.8 1 0 5.3 0 1.1 2.6 2.7 10.3 15.2 18.9 20.5 20 5.1 8.1 23.6 20.8 6.7 30.6 26.7 18 43.9 36.4 87 26.3 28.4 86.7 34.5 62.7 92.5 99.4 27.4 67.6 73.1 36.4 119.4 105. 54.8 39.1 72.9 50.5 23.7 69 17.2 16.6 1.3 12.8 29.8 9 36.1 1.8 1 0.4 5 0 1.5 7.8 0 6.9 0.9 0 9.4 1.2 0.9 2 19.7 10.5 20.5 25.9 6.1 15.5 10.6 9.5 7 19.5 27 12.9 12.9 21.7 24.5 18.3 43.1 17.8 16.3 9 34.4 39.6 10.3 13.2 18.3 23.9 37.3 15.3 30.6 7.2 27.8 23.8 9.2 24 16.6 55.1 7.2 31.4 28.5 17.6 39.6 45.7 61 39.6 83 48.2 58.6 84.7 81.9 77.6 48.1 104.6 69.7 75.8 54.5 48.6 74.3 32.4 49.1 88.6 56.6 50.8 54.8 40.5 59.2 61.9 62.4 80.3 49.9 53.1 42.8 34.4 117 60.9 65.4 103.1 29.9 60.9 12 20.3 90.7 24.7 32.6 20.4 27.7 8.8 24.1 35.7 10.8 39.4 18.1 17.8 30 12.1 29.6 23.4 21.9 32.5 24.5 23.8 41.4 12.4 22.5 26.8 26.6 13.7 54.4 35.9 9.9 52.3 38.7						

Total	805.6 928.3 532 950.9 965.1 690.2 1007

2099

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2000 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	6.9 4.6 0 0.3 7.4 0 8.1 6.1 11.3 0 0 2.2 0.2 0 3.1 1.2 3.3 3.4 2.3 0.4 0 1.3 3.5 0 2.1 5.6 3.6 12.7 4.7 1.1 0 4.4 0.6 0 3.2 0.5 0 0.2 0.3 1.(1.4 12.1 0 2.1 0.9 0.6 8.3 4.4 14 2.1 1.2 0 4.2 0.1 3.8 6.5 4.9 0 1.9 5 1.3 3.1 27.5 0 3.7 3 2.2 5.5 11 5.7 12.1 5.4 6.2 1.4 0.4 18.3 23.6 14.6 2.7 11.8 9.2 0.8 15.6 2.9 16.7 3.7 0 0.4 4.6 3.2 38.4 13.7 10. 14 12.4 11.4 26.5 15.8 14.9 2.5 10.2 13.7 14.3 28.3 8.9 11.4 0.8 7 13.5 1.6 19.9 0 0.5 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 2.5 0.3 0.9 2.8 0.4 9.3 5.9 4.8 12.3 6.2 2.1 28.5 3 10 7.4 6.9 2.3 3.5 12.5 6.6 18.5 3.8 8.7 3.3 5.4 15 49 13.5 16 3.1 2.8 2 0 0 0 0 0 0.1 0.2 0.5 12.8 2.5 (0 0 2.3 0 16 3.2 0 0.2 0 1 3 2.5 0 0 0 0 5.8 0 0.5 0 0 0 0 0 0 0 0 0 3.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	207.4 159.5 69.8 101.9 100.2 104 266.8

2100

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2000 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0						

Total	0 0 0.3 0 0 0 0

2101

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2001 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2102

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2001 : Month - April							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 0 2 0 0 0 0 1.8 0.1 3.7 0.5 0.2 0 0 0 0 3.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 0 4.6 0 0.3 0 0.3 0 0 4 0 0.7 0 0.7 0.7 0 10.3 0.8 0 0 0 1.3 0 0 0.5 0. 1.6 0 0 1 0 0 0 0 0 1.1 0 0 0 0.4 0 0 0 0 0 12.1 0 2.6 14.1 0 0.5 1.3 0 0.4 0 0 0 0 0 0 0 0 0.3 0 0 4.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0 0 0 0 0 0 4.8 0 1.2 8 0 0.4 0 2.1 0 1.7 14.9 0 2.5 0 0 0 0.5 3.6 0 0.9 0 0 0 0 0 0 0 0 1.8 0 0 6.2 0 0 0 0 0 0 0.6 0 0 0 1.4 0 1.4 0 0 0 0 0 0 0 0 0						

Total	13.4 13.2 6 19.2 46.6 2 30.4

2103

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2001 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0.9 0.2 5.2 0.6 0 0.5 0 1.5 0 0 0 0 0 0 0.8 0 0 0 0 0 0 2.3 0 0 0 0 8.2 2.6 0.5 19 8.4 0 7 38.9 8 4.1 26.3 16.4 1.2 6.1 13.3 4.8 24.1 3 1.1 4.6 9.2 50.6 15.7 40 43.2 16 69.1 16.9 34.2 52 24 63.5 22.8 20.9 27.4 12.9 19.4 14 27.6 16.9 15.7 28.3 25.9 54.8 33 31.4 39.5 21.8 25.9 129.8 70.2 41.9 66.1 75.7 84.6 122.1 77.5 53.2 19.4 65 59.5 30.8 76.9 103.5 80.2 54.2 88.2 67.2 90.2 75.2 19.5 40.4 6.6 9.9 63.7 35 52.6 12 28.5 3 8 24.4 9.8 26.3 14.4 16.4 8.7 9.7 43.5 3.9 39.8 10.4 21.6 2.1 9.8 23.6 5.9 47.8 53.6 43.5 66.8 45.5 45.3 20.4 33.2 36.8 22.8 11.4 31 15.7 21.8 17.7 38.7 20 17.9 13.4 14.4 7.7 19.2 57.8 25.3 5.9 21.7 18.1 3.6 22.1 6.6 7.2 0.2 0.6 2.4 0 2.5 7.2 10.7 0.7 8.3 3 0.2 3.1 5.8 6.3 3.7 10.4 6.9 4.6 10.7 9.6 18.7 2. 4.6 4.4 1.3 10.9 18.6 27.7 5.2 6.7 9.8 9.6 19.6 44 52.1 20.9 20 39 26.4 37.9 69.4 70.7 81.2 81.1 51.8 58.4 86.9 64.3 32.9 26.3 30 26.7 16.7 55.5						

Total	963.5 811.2 518.5 781.4 717 564.2 881.3

2104

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2001 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	43.5	1.5	12.2	21.9	4	8.4	7.1 12.1 1.5 32.4 20 4.8 26.3 5.6 56.7 18
12	57.3	67.2	36.5	61.5	35	48.3	105.2 12.1 94.7 185 42.9 169.3 21.7
13	30.8	8.4	25.1	43	12.7	59.8	10.1 10.2 2.5 15.2 24.4 6.5 22.2 11.5
14	16.1	3.8	18.1	27.7	11.1	28.5	17.7 4.4 13.1 9.8 9.7 17.4 12.9 26.6
15	9.5	10.7	14.8	18.9	4.9	18.7	13.3 26.3 8 23.7 31.9 16.7 22.4 2.2
16	33.8	9.5	38.2	50.1	19.5	44	21.2 21.7 7.3 28.1 45 11.1 35.2 36.6
17	11.6	16.2	15.7	30.7	17.2	20.5	15.8 42 19.6 65.4 51.3 23.4 49.9 28
18	46.3	29.4	43.6	72.7	24.6	56.3	22.2 40.9 6.3 50.9 58.5 24.3 67.1 4
19	41.4	14.6	19.6	37.2	10.6	43.6	24.8 34.2 20.4 19.8 58.4 35.7 46.1
20	33.9	37.2	20.5	23.3	38.4	16.6	34.7 11.5 23.5 6.2 18.6 16.7 8.2 17.
21	38.4	32.6	37.8	31.7	41.9	17.7	40.7 7.1 35.2 5 24.8 35.1 6.7 48.8
22	24.5	25.3	4.3	27.1	33.9	14.6	48.5 31.5 21.3 15.8 37.7 35.7 13.8
23	53.3	22.8	26.7	5	23.9	19.4	1.3 26.8 4.6 9.5 3.2 12.9 18.2 1.1 9.6
24	8.6	9.4	4.8	9.1	17.4	2.4	12.3 6.2 25.9 3.6 21.6 25.8 1.8 11.6 8.7
25	18.8	1.5	10.1	14.4	22.6	29	3.7 25.4 0.3 3 7.8 3.8 19.7 0.4 17.7 1.6
26	14.8	18.5	1.1	11.5			
27							
28							
29							
30							
31							

Total	655.9 804.8 393.4 850.4 1113 486.5 1108.5

2105

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2001 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	7.6	11.9	0	0	2.7	0	0
15	1.2	0.2	0.4	0.7	0.7	0.6	3.9
16	8.2	6.6	6.6	22.5	9.6	24.4	2.7
17	8.9	8.5	7.8	4.4	0.4	15.1	6.8
18	0.4	1	0.3	0	0	0	0
19	5.1	0	0	0	0	0	7.4
20	6.6	8	0	2.8	1.2	1.9	2.5
21	0	0.1	17.4	2.9	14.8	10.3	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
14	0	0	0.2	0	0.2	0	
15	0.2	57.2	7.9	22.7	1.3		
16	14	2.7	7.4	16.4	9	3.6	30.9
17	3.2	0	0	0.3	0.3	0	3.6
18	0.3	0.4	0	3	1.1	0.8	12.9
19	0.7	6.9	0.5	1	10.2	0	0.6
20	1.4	0	0	0.5	0.4	3.1	6.8
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0

Total	140.6 48.3 83.4 163.3 48.9 173.4 91.5

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15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 2001 : M o nth - De c ember

Year - 2 002 : Month - Jan u ary

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DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2002 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 3.3 0						

Total	0 0 0 0.2 0 0 3.3

2108

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2002 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.1 0 0 0 0 0 0 0.6 4 0.5 0 4.1 0 0 0.7 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 0 0 0 0.9 0 0 0 0 0 0.7 4.5 0 0 2.9 0 0 0 2.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.2 2.1 0 0.6 0 0 9 5.6 1.5 0.4 8.3 3.6 0 0.8 0 0 0 0 1.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 0 0 0.6 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0						

Total	12.5 16.3 1 9.1 14.7 0 9.8

2109

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2002 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	26.7 13.8 4.1 9.5 4.5 0.3 5.4 21.8 24 6 8.6 17.4 1.5 15.6 56.5 14.7						
12	105.5 57.8 21 44.9 39.5 1.7 8.4 0.5 0 1.8 7.3 0 13.7 9.6 0.3 0.1 0.						
13	0 2.2 4.6 0.6 0.3 8.5 0 0 0.8 0 1.1 16.7 3.8 0 1.7 0 2.6 3.8 19.6 17						
14	0.4 2.6 1.5 0.3 1.2 1.4 1.3 0 1.6 20.9 1 7.6 0.7 0.2 1.6 0.2 0 5.5 3.						
15	60.8 32.4 2.3 51.3 22.9 4.8 6.6 29.3 6.1 2.9 4.1 4.9 1.6 20 6.2 13.						
16	3.2 1.6 3.9 92.9 45.2 57.5 45.7 4.1 27.1 19.5 127.6 66.5 179.1 55						
17	75.6 164.5 87.7 111.1 35.4 92.5 109.9 13.5 104 61.5 102.8 34 87.						
18	68.4 62.5 51.8 43.1 66.4 35.8 35.8 33.1 26.9 54.9 32.3 69.1 48.1						
19	37.2 59.3 36.4 65.4 55.8 39.3 33.7 67.8 62.6 38.2 74.3 46.4 74.1						
20	52.8 134.9 84.8 50.8 94.4 53.4 42.2 44.7 36.3 65.3 44.1 45.5 69.1						
21	61.2 52.6 72.8 103.4 83.1 68.4 73.4 21.8 48.6 3.5 85.8 100.8 41.4						
22	120.2 17.8 59.3 11.1 49.7 65.5 13 57.1 18.5 29.7 4.2 20.4 32.9 11						
23	62.8 26.6 31.6 14.2 34.8 72.3 45.1 83.1 10.1 8.3 0.4 9 20.7 9.3						
24	36.5 6.1 8 6 10.4 14.4 5 14.5 11.1 12.2 3.2 7.2 22.8 6.1 9.9						
25							
26							
27							
28							
29							
30							

Total	1039.5 761.5 1095.7 1064 820.4 998.9 1043.9

2110

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2002 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	2.6	13.4	6.3	9.5	10.2	28.8	10.8
13	13.8	11.1	12	14.5	15.6	82.9	44.5
14	66.7	48.1	60.2	31.7	32	23.1	46.5
15	90.1	15.1	113.4	7.8	37.9	1.5	8.5
16	121.2	123.3	166.1	83.8	92	83	107.3
17	65.5	78.4	94.6	54.8	77	31.4	39.5
18	4.2	15.4	54.1	8	47.2	10.4	15.2
19	8.2	23.9	3.3	21	27.8	46.7	16.8
20	66.1	55.3	30.8	44.5	33.8	53.6	16.8
21	56.9	78.6	47.8	131.2	16.5	22.9	7.2
22	1.7	11.6	14.4	2.2	21	9.3	14.2
23	7.3	14.4	19.5	32	6.2	8.8	13.9
24	10.7	14.1	10.5	13.7	31.3	13.1	40.8
25	0	0	0	0	0	0	0
26							
27							
28							
29							
30							
31							

Total	677.6 941.1 569 1043.1 1228.9 822.4 1383.9

2111

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2002 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	4 8.1 1.6 1.4 0.6 0.2 4.9 0 0 0 0 0 0 0 0 4.6 0 2.1 3.5 0 30.7 12.1 8.3 10.6 3.1 5.8 4.2 0.2 22.1 0 0.2 88.9 0 0 11.8 11.6 0 0 8.1 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0 7.8 0 46.1 6 18.9 43.6 1.8 8 41.2 8.3 10.1 5.4 1.8 6.6 27.6 0.5 17.4 7.5 5.8 23.4 11 5.8 24.6 9.2 16.7 6.1 23.8 6.5 38.2 12.2 6.2 8.7 6.8 35.7 14.5 10.4 29.2 3.6 4.6 0.5 4.5 6.3 0 3.6 10.5 19.8 2 18.4 8.4 0.5 4 38.3 30.7 14.2 111.3 59.3 23.4 32.5 1.4 2.9 1.6 1.8 5.7 12.3 0.1 3 8.3 0.2 0 2.3 3.6 6.6 0.4 0 0.1 0.2 2.5 0.2 0 0.7 3 0.8 3.5 3.3 16.3 0 0.2 0 3.2 3.6 3.9 12.9 0 3.2 0 0.2 1.3 0 3.9 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0 0 0 1.9 0.4 3.4 1.1 0 0.3 1.6 17.1 3.2 0.9 6.4 1.9 0 0.5							

Total	216.8 139 90.6 379.7 136.6 145.4 249.9

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2002 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2113

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2003 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2114

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2003 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	1.4	0	2	3.5	0	0	0
18	0	0	0	0	0	1.4	0
19	0	0	0	0	18.7	2.4	0
20	0	0	0	0	1.5	2.7	1.2
21	0	3.4	0.2	14.7	0	0	5.6
22							
23							
24							
25							
26							
27							
28							
29							
30							

Total	1.5 32.2 1.9 23.4 28.6 1 28.4

2115

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2003 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0 0 0 0 0 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
13	0 0 0 0 0 0 0 0 0 0 0.2 6.4 0.7 0 2.2 0 0 0 0 0.3 0 0 0.1 3 4.1 0 0.4 1						
14	0 1.2 4.5 3.6 6.8 1.9 0.9 3.5 6.5 9 18.5 5.1 6.3 8.5 3.2 40.4 17.9						
15	20.9 26 27.9 19.8 20.8 68.4 21.8 32 31.6 36.1 32.2 22.3 25.5 29.5						
16	41 18.9 17 52.3 12.7 66.8 56.6 62.5 74.8 57.7 70.4 60.4 55.1 66.9						
17	42.7 29.5 103.1 32.8 28.9 61.4 36.4 70.3 91.3 65.5 78.7 63.3 59						
18	36.7 57.4 34 50.6 82.2 30.3 71 74.1 24.6 79.7 94.8 22.8 57 141.2						
19	79.3 212.8 140.3 95.3 128.9 91.6 98.8 53.6 96.4 91 67.7 102.9						
20	86.6 50.6 172.6 9.8 142.6 192.3 65.4 246.6 30.8 83.7 3 45.2 108						
21	10.4 81.2 17.1 50.8 4.4 22.4 45.6 11.2 18.8 53.1 30.2 20.7 22.8						
22	35.2 14.7 23.1 46 30.5 80.1 135.3 58.5 80.9 72.9 39.5 31.4 18.7						
23	25.7 21.2 9.5 14.5 16.6 31.1 4.8 8.5 39.9 13.8 17.1 16.5 41.7 8.2						
24	24 62.8 11.1 24.7 88.3 54.8 58.3 92 114.3 83.4 55.1						
25 26 27 28 29 30							

Total	1053.9 1016.1 895 1153.9 1303.3 934.6 1036.8

2116

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2003 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.6 10.1 1.1 4.3 4 3.7 5.7 12 8.5 10.9 13.7 9.3 5.3 8.4 22.4 19.4 15.3 21.8 10.9 15.4 12.8 42 43.9 44.2 29.3 23.3 82 24.7 112.7 63. 76.7 104.5 92.5 86.6 63.3 49.7 53.6 25 50.5 48.6 74 41.3 34.4 24 19.6 30.8 36.1 42.4 30 7.5 14.2 4.2 12 28.5 7.2 15.6 9.6 10.7 2.3 3.7 6.4 4.7 3.7 27.1 11.2 4.1 19.2 24.9 11.6 11.3 7.7 9.5 5.4 15.8 36.2 13.5 13.7 27 10.3 6.9 19.8 21.6 10.9 16.2 15.6 12.7 3.5 18.6 18.4 12.3 14.3 15 29.4 6.5 14.1 38 9.1 16.3 26.1 22.1 13 29.1 33. 23.7 25.8 27.4 30.6 4.7 25.3 21.1 20.8 16.1 9.3 21.1 11 31 21.2 11.7 18.7 25.3 32.5 10.8 40 39.4 17.2 26 42.5 33.8 31.7 75.9 50.5 31.3 43.7 36 44 21.9 80.8 65 35.8 59.3 21.7 56.5 12.9 38.6 72.6 31.5 50.1 12.7 26.1 1.4 9.1 21.2 2.9 13.2 6.5 32.1 0.7 14.4 41 10. 24.3 4.6 10.7 0 9.5 13.9 5.5 9.3 19.6 14.6 12 18.1 27.6 7.3 21.9 12.3 21.1 9.9 20.7 43.8 21.5 21.6 9 6 4.2 5.5 13.2 7.1 11.7 7.7 7.6 3.7 2.7 15.4 5.9 6.9 19.9 15.4 8.2 11.6 31.1 17.2 19.8 13.6 16.9 24.7 10.9 13.6 20.1 7.6 10.9 8.6 13.7 16.4 15.9 10.1 12						

Total	689.4 721.1 410.2 797.7 939.1 659.1 665.3

2117

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2003 : Month - October							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1.2 7.6 0 0.2 0 0 0 0.7 16.7 0 0 0.4 3.9 5.7 3.5 14.5 0.7 8.1 19.6 11.5 6.1 36.1 23.2 8.2 0.2 26.6 13.9 2.8 47 17.2 24.9 38.6 33.3 23 19 22.3 4.8 0 0.4 6.4 0 0 0.6 0.2 0 0 1 0 0 0 0.1 8.6 0 0.8 2.2 5.6 0.2 0 0 0 0 0 3.1 0 0 0.3 0 0 0.3 0 0 1 0 0 0.5 0.2 2.8 0 0 0 0 0.3 22.7 11.1 0 0 0.5 0.9 0 0 0 0 0 0 0 0 0 0 3.9 0 0 0 0 0 0 2.4 1.1 0.5 26.4 3.4 2 10.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.4 0 0 0 0 0 0 5.4 0 0 0 0 0 11.7 13.9 3.3 12.6 14.9 1.5 15.4 4 5.5 4.2 27.9 8.3 0.6 19.4 10.2 5.2 0 1.1 4.1 0.9 2.3 0 0.4 0 0 2.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	143.8 118.2 51.2 116.4 122.2 82.8 103.6

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2003 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2119

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2004 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

2120

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2004 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0.6	0	0
16	2.4	0	12.6	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	0.6 2.1 0 0 7.5 1.8 23.5

2121

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 2004 : Month - J une

Year - 2004 : M onth - July

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

0.1

30.6

6.6

0

0

5.5

7.9

36.2

96.2

59.4

55

14.7

29.8

32

36.6

56.1

22.3

35.5

6.8

4.6

5.9

1.1

0

7.6

21.4

106.3

16

21.6

6.6

13.7

736.1

0

0.8

1.2

5.9

4.9

6.6

11.8

38.6

82.2

93.7

54.8

38.7

40.5

56.1

71.5

85.5

53.1

49.7

34.6

4

8.1

2.5

3

14.2

38.6

18

24.4

29.4

29.5

15.3

917.2

1.7

47.2

2.3

0.4

0.2

4.8

35.7

32.3

107.3

110.9

52.6

1.6

12.3

8.2

12.8

27.2

5.6

4.4

1.7

0

0

0

0.3

1.2

32.1

95.8

17.6

2

0.9

4

623.1

2.1

43.3

16.4

0

0

0

0.4

14.8

82.8

119.8

92.7

16.5

18.8

27.6

48.5

58.3

27.3

21.7

6.9

1.7

20.2

4.4

0.1

0.1

29.2

47.6

14.1

22

43.9

26.8

808

0.3

14.1

6.2

3.3

1.8

19.6

6

9.1

52.9

134.7

58.2

41.2

43.7

85

89.2

143.6

89.8

89

19.1

11.5

23

8.8

0.2

2.3

28.1

23.4

12.4

40.1

42.2

30.9

1129.7

5.4

11.4

19.8

1

0

20

15.9

20.9

140.9

116.8

52.6

10.2

22.2

43.2

29.1

58.7

24.7

45

4.1

2.1

12.2

6.3

0

0.3

34.6

86.7

42.6

13.8

3.4

11.9

855.8

8.3

16

11.8

3.3

1.1

10.7

0

4.6

45.5

71.4

33.8

11

16.5

39.6

52.8

100.8

63.7

33.2

17.6

2.8

12.1

3.1

0.2

0.2

12.4

12.6

10.5

29.4

14.7

11.3

651

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

Total

2122

22.8

37.8

32.6

21.9

22.6

19.7

1.7

0

2.4

46.3

46.1

87.9

34.7

14.2

20.7

40.9

32.9

23.1

11.9

24.8

15.5

23.2

20.4

35.9

13.1

26.5

28.1

13.4

69.7

68.1

23.7

882.6

71.4

60.7

39.4

21.2

27.4

7.8

3.9

3

18

21.7

32.1

30.3

31.7

20.9

40.6

23.9

19.4

18.2

7.5

12.4

24.2

20.6

43.1

37.2

31.6

23.7

26.3

55.2

59.7

57.2

89.3

979.6

11.3

92.8

7.6

1.5

5.4

4.5

2.5

2

21

34

28.8

26.2

0.7

15.8

30.1

34.7

28.3

8.7

12.9

11.6

23.7

16.2

6.7

23.1

18.1

28.2

27.4

12.1

43.8

39.5

7.2

626.4

78.7

134.1

16.3

15.8

18.7

6.1

3.5

1.3

11.5

46.7

30.5

50.8

23.9

29.2

27.9

25.8

13.6

8.3

5.1

14.8

70.2

19.2

46.8

22

7.1

14.1

43.2

39.6

78.3

44.7

28.1

975.9

141.3

94.1

23.8

27.6

55.8

18.6

14.8

0.1

3.3

12.3

14.7

43.2

94.6

27.3

71.5

37.9

23.6

57.3

12.7

17.7

42

54.7

87.9

97.6

9.7

33

43.6

53.7

94.2

81.4

85.9

1475.9

22.8

101.1

4.8

1.4

15

24.3

4.4

3.9

7.5

38.8

27.1

65.3

12.4

12.3

38.6

35.8

25.1

21.3

3.7

22.9

31.7

14.2

9.4

16.7

20.8

16.1

27.6

11

59.2

72.7

20.8

788.7

33.2

46

8.1

11.4

22.7

4.7

2

0.2

0.9

4.5

2.5

14.3

17.9

8.9

11

9.2

5.8

6.4

2.9

4.6

23.2

2.9

33.4

14.7

3.5

9.1

26.4

17.7

33.4

61.5

24.9

467.9

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2004 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	40.6	65.9	25.4	37.9	87.9	34.6	33.9
12	30.9	101.1	27.7	25	117.4	23	22.7
13	86.4	182.9	53.8	73.7	178.6	41.5	57.9
14	87.2	178.5	57.5	84.1	210.8	96.2	129.6
15	73.4	98.8	31.5	50.3	154.2	47.7	48.2
16	21.1	45.4	11.6	44.6	75.8	22.4	39.3
17	8.4	60.4	19.7	40.6	96.5	21.2	22.6
18	53.1	40.5	32.6	33.6	116.9	52.9	30.9
19	31.7	41.5	10	58.1	57.9	29.8	27.2
20	22.3	24.5	10	23.8	54.5	8.6	12
21	19.8	63.6	10.1	31.5	103.4	8.8	16.7
22	48.3	117.2	26.7	67.9	115	54.5	44.7
23	70.4	101.6	28.2	44.7	114.4	31	32.7
24	41.8	33.1	8.8	21.5	32	14.1	17
25	17.8	27.3	11.1	21.1	71.7	18.5	17.7
26	34	52.1	15.7	29.3	55	12.4	19.1
27	34.6	53.8	19	29.4	41.6	21.8	15.9
28	17.8	22.1	8.8	21.7	42.2	20.6	10.2
29	17	17.5	15.5	14.8	21.9	10.	13
30	10.5	15.5	6.1	12.8	37.1	17.8	8.6
31	9.1	20	4	7.5	13.1	9.7	7.8
	11	12.1	3.5	5.2	17.2	11.8	12.3
	19.5	28.3	11.6	21.2	43.4	11.6	11.8
	17.	24.3	19	35.6	39	18.9	17.4
	9.3	12.7	4.1	17.2	26	12.5	9.9
	0.8	11.4	0	4.3	13.6	1.4	4.3
	6.5	3.8	0.6	6.8	10.5	4	7.4
	0.2	8.3	0.4	3.4	7.6	0	1.2
	0.1	0.7	0.1	2.6	5.4	0	1.1
	0	0	0	0	0.6	1.1	0
	12.4	0.1	1.5	0.5	0.7	1.4	

Total	853.9 1465 474.9 870.7 1961.9 660.9 693.1

2123

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2004 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0.9 0 0 1.9 0 0 7.9 0.4 0 0 1.1 6 9.4 5.5 1.3 5.4 0 0.8 0.3 18.4						
16	15.5 19.3 8.8 2.8 7.8 0 22.3 14.2 8.6 24.8 41 8.8 11.2 0 0.1 0.2 0.3						
17	2 2.1 3 0 0.9 0 0.7 5.6 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 1.4 0 2.1 0 0 0 0 0 0 1.9 4.8 15.7 6.1 6.4						
19	20.3 0 18.2 0.7 31.8 11.7 0 3.4 0 0 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 (						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22	0 0.1 0 0 0 0 0 0 0 4.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
23 24 25 26 27 28 29 30 31							

Total	70.2 49.6 79.2 57.8 59.3 51.6 22.6

2124

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2004 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2125

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2005 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 1.3 0 0 1.4 0.2 0						

Total	0 0 1.3 0 0 1.4 0.2

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2005 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	3.9	2.3	0	2.3	0	0.1	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	1.7 4.4 32.9 25.8 16.1 19.8 25.4

2127

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2005 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	22.9	18.5	2	1.7	11.9	1.7	7.7
13	0	0	0	0	0	0	0
14	11.9	26.8	55.7	58.2	41.5	39.4	49.8
15	0.4	0.1	0	2.3	0.2	2.2	0
16	1.4	1.7	1.4	23.3	15.6	3.1	17.9
17	2.8	1.1	5.1	9.2	33.7	15.8	13.4
18	33	53.2	65.1	82.3	107	85.1	81.1
19	87.9	80.7	94.8	46.8	74.2	79.2	37.3
20	121.8	105	117	106.6	165.6	68	87.3
21	69.4	52.4	73.4	12.7	17.3	1.9	36.2
22	12.2	7.4	10.2	10.4	13.6	6.6	40.7
23	27.6	15.2	25.5	103.8	114.1	34.5	120.3
24	44.9	82	61.6	45.5	65.4	73.3	75.6
25 26 27 28 29 30							

Total	852.1 919.4 827.5 1072 950 830.4 953.1

2128

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2005 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	15.3	21.1	15.5	33.2	26.7	12.9	26.9
13	41.2	44	8.5	26.4	32.6	10.7	20.6
14	6.4	8.5	1.6	17.3	13	6.4	11.6
15	15.9	5.6	27.3	20.7	4.9	17.7	18.7
16	93.1	78.8	109.4	101.6	54.1	96.4	8.8
17	3.7	1.4	10.2	7.4	4.5	7.3	5.3
18	8.8	0.4	5.3	21.3	23	52	21.6
19	29.4	19.9	22.7	30.9	19.2	18.6	24.6
20	109.4	81.8	110.6	47.1	43.6	21.1	31.3
21	39.1	26.6	28.9	31.2	1.5	4.1	0.9
22	15.1	1.4	12.7	13.6	13.7	3.5	15.4
23	3.8	0.2	0.3	4.6	2.2	1.2	5
24	2.7	35.9	31.9	6.4	24	0	0.4
25	0	0	0	0	0	0	0
26							
27							
28							
29							
30							
31							

Total	532.5 588 407.7 687.2 628.2 379.6 580.1

2129

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2005 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0 2.1 1.2 0.2 1.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 58.5 65.2 29.4 48 55.8 30.7 44.8 33.1 32.2 34. 36.9 33.3 33.5 32.6 49.1 45 27.8 13.4 30.2 26.6 25.2 6.4 2 13.6 0 1.2 8.8 3.4 1.2 4.2 1.6 16.9 10.4 3.9 10.5 0 0 0 0 0 0.1 0 0.1 2.9 0 19.9 11.8 2.4 12 16.9 14.2 0 4.8 9.1 0.5 3.9 27.1 37.7 4.8 47.6 41. 12.8 33.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 28.6 26.2 9.7 15.5 18.6 12.1 12.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	221 229.9 121.8 205.4 213 131.6 179.8

2130

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2005 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 1 0						

Total	0 0 0.1 0 0 1 0

2131

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2006 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2132

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2006 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0.4	0	0	0.6
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0.4	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0					
22 23 24 25 26 27 28 29 30							

Total	0 0 0.5 3.3 3.2 8.5 8.2

2133

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MONTH OF

Year - 2006 : Month - J une

Year - 2006 : M onth - July

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

103.5

85.1

54.7

31.9

36.2

36.6

6.8

13.4

2.6

39.4

4.2

3.9

0.3

4

2

0

6.1

8.7

1.9

12.2

21.9

8

0.1

40.1

57.4

85

54.9

74.9

117.8

104.4

1018

51.2

45.1

39.6

19.7

12

20.5

4.2

7.6

0

17.6

1

1.5

0.2

8.4

0.9

0

4.8

1.5

4.7

3.1

18.4

8.8

0.4

28.9

46.8

71

24.6

30.9

76.8

24.8

575

66.3

35

92.6

14.7

27.6

13.2

3.4

6.1

3

0.7

7.3

0.9

0.8

0

0.2

17.1

33.9

0.8

0.3

0

71.2

4.1

0

65

46.7

62.2

28.5

67.2

28.1

15.3

712.2

106.1

119.1

76.3

59.6

40.1

23.6

4

23.2

0.2

30.2

1.5

7.9

0.5

0

1

3.3

3.7

15.3

14.4

3.8

36.4

20.2

1

26

42.4

125.1

99.6

97

143.7

126.6

1251.8

86.1

70.2

55.2

40.2

33.2

15.1

9.5

12.1

0

47.8

2.9

7.6

0.4

1.5

2.6

0

4.9

16.2

6.7

8.9

16

6.8

0

20.3

37.6

95.5

39.5

40

81.7

72.7

831.2

55.8

27.9

55.3

13.1

46

9.8

0

17.1

7.2

9.1

46.8

3.3

1.7

0

0

1.5

7.7

3.9

0.7

4.3

20.8

14.3

0

24.3

26.2

43.2

86.1

82.2

46.1

15.7

670.1

73.4

106

90.6

67.4

38.6

27.3

1.1

25.2

0.3

48

5

11.8

0.9

0

2

6.6

6.1

3.8

20

8.7

49.1

30.4

1.9

29

41.3

133.8

105.6

88.5

108

98.3

1228.7

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

Total

2134

54

97.3

111.1

121.4

108.3

93.4

47.3

125

22.2

44.9

45.4

41.5

15.9

38.1

22.5

15.6

51.3

73.3

129.9

79.9

62.3

85.7

65.4

56

28.5

32.6

73.7

135.8

72

90.5

21

2061.8

48.7

74.9

106.2

84.8

78.1

74.5

29.2

69.2

14.6

30.1

26.4

38.6

24.7

26.1

23.1

14.8

41.3

32.5

79.2

40

58.4

32.5

44.3

34.9

16.4

25.7

61.1

103.1

75.9

59.5

5.3

1474.1

8

16.3

11.6

6.7

4.2

25.7

8.7

10.7

2.3

12.9

4.4

12.6

2.1

4.3

1.5

5.9

2.9

11.4

15.1

15.9

5.9

34.8

21.6

8.2

4.8

4.6

11.5

28.1

23.5

18.3

25.2

369.7

69.6

140.8

155.4

143.7

127

128.1

82.5

71.7

44.8

46.4

45.5

44

20.6

40.5

23.6

34.6

53.7

85

135.4

119.2

89.8

123.8

117

94

45.1

53.5

84.9

175

130.9

138

40.6

2704.7

78.5

105.6

137.4

114.4

100

102.7

54.5

78.7

29.6

39.7

35.5

47.4

25.1

28.3

26.4

21.4

55.6

52.2

111.9

71.5

62.9

81.7

87.4

46.6

34.8

32.8

102.2

147.7

122.4

107.4

70.6

2212.9

16.5

76.2

36.1

23.9

35.5

45.6

15.2

23.7

7.5

7.4

14.2

17.1

13.6

6.9

2.5

10

10.5

26.9

29.2

21.8

27.2

29.4

69.5

44

13.4

18.2

23.5

108.9

27.5

23.6

2.2

827.7

56.6

152.3

134.5

119.2

106.3

87.9

42.4

47.5

38.5

37.9

30

65.6

30.6

56

28.6

31.6

63.9

89

131

89.6

69.6

61.7

97.5

91.7

33.6

45.7

114.4

153.6

82.1

76.6

10.3

2275.8

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2006 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	128 78.9 19.8 124.3 98.1 38.5 99.4 35.2 24.9 12.9 42.5 36.3 11.1 31.9 77.6 58.2 35.6 88.6 55.3 48.9 107.5 74.3 40.4 7.7 88.2 53.6 11.2 40.6 40.4 36.9 12.8 53.4 52.4 21.1 59.7 59.4 28.6 23.2 62 34 38.5 55.4 84.8 28.4 5.5 88.1 70.5 2.5 35.8 144.6 64.3 90.2 127.3 121.4 64 104.5 85.5 46.6 71.4 94.3 71.9 31.4 68.1 73.5 35.4 8.7 96.1 63.4 29.6 99 169.8 94.6 9.8 157.8 129 23.9 125.7 123.3 132 28 130.2 130.4 26.4 110.3 72.7 42.9 9.9 87 54 8.8 79.4 145 53.6 36.8 117.5 103.1 29.4 78.7 106.7 53.5 28.4 89.4 86.6 28.7 72 136 105.6 22.1 131.4 129 57 114.9 144.8 109.1 32.6 118.1 117.5 25.1 79.6 86.1 58.8 24 61.9 66.5 19.7 68.6 48.8 18.3 15.5 49.8 31.5 16.9 28 20.2 5.9 7.6 26.7 17.2 10.7 26.9 18 7 2.3 19.2 11.2 8.9 20 6.2 4 6.5 5.5 7.9 1.2 4.1 3.3 2.3 0.9 4.8 3.3 2 6.3 9.1 1.5 4.1 11.1 6.1 3.8 3 3.7 1.5 13 4 5.3 1 5.9 0.6 0 0 0.4 0 0 0.8 2.9 0 0 5 0.8 5. 1.6 19.4 21.1 5.6 29.5 23.3 21.3 46.2 23.4 31.3 45.2 27.6 13 36.4 45.8 10 5.3 1.8 13.1 8.6 7.8 22.6 1.3 2.7 0.9 19.1 9.2 0.7 34.9						

Total	1954.7 1194.1 582.8 1973.9 1610.4 632.1 1678.1

2135

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2006 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	8.3	15.3	8	3.6	11.7	22.1	3.2
15	68.7	81.7	95.5	38.7	60.1	111.8	34.5
16	52.1	12	10.6	22.7	22.2	6	1.3
17	2.8	6.4	0.8	10.5	10.3	7	6
18	40.1	18.4	9	7.8	16.6	0	1
19	0.9	3.1	0.2	2.2	3.1	3.4	3.4
20	21.3	11	0	20.9	11.5	0	8.5
21	0	0.1	0	0	0	0.2	2.5
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	74°15'E 15°45'N	73°45'E 16°E	74°E 16°15'N	74°15'E 16°15'N	73°45'E 16°30'N	74°E 16°30'N	74°15'E 16°30'N
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	14.4	10.2	10.9	15.4	8.3	15.3	8
15	18.2	10.5	40.1	33.2	5.7	5.9	68.7
16	9.1	28.5	29.1	27.2	29	20.6	19.1
17	1.1	48.1	10.3	3.2	16.1	6.1	7.1
18	1.5	4.1	0.3	0	0.9	3.6	0.5
19	0.8	0	0	0	0.5	0	0
20	0.9	0	4.4	0.5	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	73°45'E 16°30'N	74°E 16°45'N	74°15'E 16°45'N	73°45'E 17°E	74°E 17°15'N	74°15'E 17°15'N	73°45'E 17°30'N
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	11.7	22.1	3.2	12.5	17.4	131.5	14.4
15	60.1	111.8	34.5	18.2	10.5	40.1	33.2
16	22.2	6	1.3	19.4	9.1	28.5	29.1
17	10.3	7	6	1.7	1.1	48.1	10.3
18	16.6	0	1	0	1.5	4.1	0.3
19	3.1	3.4	3.4	0.8	0	0	0
20	11.5	0	8.5	0	0.9	0	4.4
21	0	0.2	2.5	0	0	3.9	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Date	74°E 17°30'N	74°15'E 17°30'N	73°45'E 17°45'N	74°E 17°45'N	74°15'E 17°45'N	73°45'E 18°E	74°E 18°15'N
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	10.2	10.9	15.4	14.4	18.2	10.5	40.1
15	18.2	10.5	40.1	33.2	5.7	5.9	52.1
16	9.1	28.5	29.1	27.2	29	20.6	19.1
17	1.1	48.1	10.3	3.2	16.1	6.1	7.1
18	1.5	4.1	0.3	0	0.9	3.6	0.5
19	0.8	0	0	0	0.5	0	0
20	0.9	0	4.4	0.5	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24 25 26 27 28 29 30 31							

Total	156.7 210.9 436.1 190.5 188.6 222.9 188.7

2136

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2006 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2137

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2007 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0.7

2138

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2007 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0.4 0 0 3.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7.2 0 0 0 0 0 0 6.3 0 0 3.1 0 0 0 9.9 0 0 3.8 0 0 1 1.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 0 14.7 0 0 15.4 0 0.4 0 0 0 0 0 0 0 0.4 6.7 0 0.7 4.5 0 5.2 0 0.2 0 1.5 5 0 3 0 0 0 0 0 0 0 0 0 0 0 0.1 1.3 0 0.9 0 1 0 0.8 0.6 0 5.3 0 0 0 0.3 0 0 0 0 0 0.3 0.3 0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0 2.1 0 0 0.4 0 0.2 0.2 0.3 0 0.7 25.2 0.9 0 1.4 2.3 0 9.3						

Total	27 49.1 0.2 5.8 39 0 31.3

2139

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 1.9 0 0 0.2 0 3.1 4.6 11.5 0 0 5.2 0 6.8 0.7 18.4 18.9 0 13 4.4 (0 8.3 0.5 0 1.5 1.7 0 0 0.6 0 2.8 0.2 0 0 0.6 0 0 0.7 0.6 0 1.7 5.1 3 0.1 0.5 10.1 13.1 0 1.3 5.3 29.9 0.2 4.4 2.6 0 11.2 2.3 3.1 5.3 13.5 3.3 16.3 0 21 8 2.4 18.1 3.6 28.2 1.1 20.1 22.1 5.6 12.3 6.2 0.9 2. 74.8 31.3 0 69.3 2.2 6.8 10.1 64 8.9 9.3 36.5 2.3 11.8 3 24.4 3.7 7 9 5 13.1 11.3 21.5 34.7 6.9 20.2 22.3 51.5 13.3 63.9 19.2 1.6 47.6 18.6 62.6 20 67 59.2 20.8 52.2 40.2 37.3 18.2 78.2 31.9 12.9 37.6 23.4 38.5 22.5 51.9 43.5 16 67.7 21 50.7 14.2 85.6 57.3 15.1 48 36.5 28.6 17.2 58.9 49.8 27.1 49.8 15.3 22.9 78.6 26.6 21.5 29 32.1 9 192.6 102.7 66.4 116.2 62.5 70.1 125.5 109.4 92.1 146.9 190.6 131.2 122.2 248 66.4 37.5 16.4 45.2 46 16.3 70.5 26.9 26.7 21.7 40.3 49 8.6 58 20.7 43.8 17.3 16.5 47.9 17.2 49.1 23.7 55.9 8.1 30.1 57.2 12.8 60 51.9 102.2 53.2 102.8 134.4 73.2 196.7 56 78.4 30.9 133.6 132.2 77.1 164.9						
Total	928.4 774.7 1070.2 1118.9 824.4 946.6 1203.4						

2140

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2007 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11	13.8	18.6	3.9	3.7	12.4	3.9	6.4
12	119.6	81.7	106.4	149.5	100.6	97.9	57.9
13	76.3	89.4	97	138.4	119.9	165.2	186.9
14	137.6	184.5	110.5	148.1	122.7	209.1	70.9
15	109.3	16	80.2	103.3	26.1	77	49
16	37.6	74.5	4.1	37.1	92.5	11.2	51.5
17	11.4	18.9	3	42.8	71.8	9.3	71.9
18	8	5.1	13.1	13.6	7.8	21.8	17
19	0.6	22.5	8.2	2.2	13	2	10.2
20	28.4	6.8	25.5	14.2	21.2	3	17.2
21	59.1	37.7	25.4	17.7	20.6	22.6	11
22	24.1	13.7	17.6	20.4	54.4	28.3	10.8
23	43.9	19.7	25.5	11.6	13.7	16.2	4
24	12.3	11.5	11.2	9.6	11.8	6.9	10.9
25	38.8	18.5	15.8	39.1	21.9	20.1	18
26	23.8	29.7	98.4	57.5	44.1	98.5	82.8
27							
28							
29							
30							
31							

Total	1157.4 1475.2 890.6 1530.3 1652.3 949.1 1349.9

2141

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2007 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	15.4	9.4	3.6	72.2	14.6	0	5.8
15	2.2	14.1	0.6	0	1.4	20.2	0
16	7.7	0.4	2.3	13.4	1.3	0	0.7
17	0	0	0	11.8	0	0	4.1
18	0	0	0	0	0	0	5.9
19	0	0	0	0.3	5.3	0	0
20	14.4	11.8	3.9	3.7	5	1.9	2.1
21	31.1	0.3	1.2	0.2	0	1.1	1.5
22	0	0	0.4	0	0	0	0
23	0	0	0	0	0	0.1	0.2
24 25 26 27 28 29 30 31							

Date	74°15'E 15°45'N	73°45'E 16°0'N	74°E 16°0'N	74°15'E 16°0'N	73°45'E 16°15'N	74°E 16°15'N	74°15'E 16°15'N
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	9.3	20.6	0.9	2.3	0.5	0.5	5.4
15	0	2.4	7.6	0	0	0	0
16	4.2	0	15.8	0	7.4	0.9	29.8
17	0.8	0	13.2	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	50.7	3.8	1.4	24.5
20	3.4	3.2	1.7	13.4	6.4	13.1	3.6
21	7.2	0.1	0	0	0	0	1.5
22	0	0	0	3.5	16.1	0	1.2
23	0	0	0	0	0	0.1	0.2
24 25 26 27 28 29 30 31							

Date	74°E 16°30'N	74°15'E 16°30'N	73°45'E 16°45'N	74°E 16°45'N	74°15'E 16°45'N	73°45'E 17°0'N	74°E 17°0'N
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	5.9	0	0	0	4.1	0
15	0	0	0	0	0	0	0
16	0	5.7	0	0	0	0	0
17	0	0	0	0	0	0	3.1
18	0	0	0	0	0	0	0.1
19	0	12.3	7	0.8	5.9	1.7	0.2
20	13.1	3.6	0.6	0	10.1	0	0
21	0	0	0	0	0	0	0.3
22	1.3	6.1	0	0	0	0	0
23	0	0	0	0	0	0.2	0.7
24 25 26 27 28 29 30 31							

Total	156.4 62.9 94.4 274.3 30.2 74.9 29.8

2142

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2007 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.9 0 0.8 1.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0.9 0 0.8 1.9 0 0 0

2143

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2008 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5.5 4.6 0.2 13.7						
18	0 4.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	5.5 4.6 0.2 13.7 9 0 4.8

2144

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2008 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 10.1 0 0.5 10.4 0 0 0.2 8.1 2.5 3 1						
17	0.1 0.1 0 0.7 1.1 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0 0 0.2 0 0						
19	0.5 0 14.7 0 2 2.8 1.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5						
20	0.7 0 3 2.9 0 0.5 0 0 0 0 0 0 0 0 0.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 1.1 3 0 0 0 0 0 0.2 0.5 0 0						
22 23 24 25 26 27 28 29 30							

Total	1.1 2.2 15 23.2 12.2 6.3 27.1

2145

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE MONTH OF

Ye a r - 2008 : Month - June

Y e ar - 2008 : Month - July

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E 15°45'N

4.9

11.5

8

1

1.1

8.2

46.3

98.9

47

48.8

62.8

52.6

35

44

51.7

53.7

4.8

27.7

38.3

26.4

9.3

10.8

30.6

63.9

21.4

41.6

32.6

36.4

90.5

102.3

1112.1

1

7.7

13.2

1

0

3.3

55.3

74

57.3

41

55

53.3

53.1

23.3

11.5

12.9

9.8

12.2

24.9

7.7

4.6

11.4

17.4

62.3

27.2

47.8

23.5

17.8

33.8

47.8

811.1

0.5

33.6

6.1

0.2

28.8

36.3

61

135.8

42.4

28.2

27.8

85.3

121.2

27.8

6.7

1.3

0.3

3.3

12.4

3.5

1.8

1.6

1.8

8.2

13.2

32

6

2.8

18.4

49.4

797.7

27.5

6.6

6.2

9.9

0.6

33.9

93.9

126.1

42

62.6

78.8

73.4

78.8

36.5

12.5

12.6

3.1

29.8

27.7

15.6

6.2

22.7

23.9

95.1

15.1

52.8

22.1

23.8

37.1

117.8

1194.7

1.5

0.7

1.5

1.1

0

3.6

48.8

70

51.5

49.9

62.9

47.9

43.8

23.7

18.5

29.6

7.3

13.5

35.5

11.7

24.2

41.7

18.2

61.7

17.9

50.9

27.6

22.1

42.6

78.7

908.6

3.7

9

41.1

5.9

4.1

12.8

37.7

76

73.3

53.9

54

62.4

89.2

24.4

10.6

4

2.1

1.8

4.7

2

1

1

6.2

8.1

5.5

25.5

3.4

3.5

23.7

52.3

702.9

2.1

5

14

0.7

4.2

8.2

63.3

82.8

43.6

73.5

80.3

82.6

61.3

34.2

49.9

38.1

13.4

41.5

20.1

14.2

8.6

9.8

12.5

47

28.9

41.1

37

24.8

41.8

135.4

1119.9

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

Total

2146

59.2

31

20.2

28.9

10.5

40.2

20

11.2

30

33.6

39.8

48.6

29.8

19.9

39.3

6.9

8.8

5

12.7

5.1

4.6

5.3

3.5

6.9

25.9

43.8

137.7

156.2

114.5

134

167.9

1301

32.3

28.2

14.7

11.9

13.8

15.6

10.9

12.1

12.3

20.1

25.8

32.2

7.7

4.5

8.5

2.2

5.6

2.9

4.7

1.9

4.5

2.2

0.9

3.5

13.9

44.8

92

109.2

68.9

71

81.2

760

11.3

14.5

1.7

6

2.8

2

5.9

0.4

13.4

7.5

6

27.7

1.8

1

1

36.9

70.2

66.2

17.8

10.9

3.7

19.9

3

1.8

33

48.7

35.3

59.8

12.8

27.6

24.3

574.9

42.2

35.4

13.4

16.1

25.8

29

22.1

8.2

21.2

21.8

54.3

44.8

47.8

5.9

1.3

63.2

10.9

13.3

7

13

19.3

27

1.4

5.6

17.5

56.5

39.7

141

45.9

54.1

64.9

969.6

53.9

52.7

25.5

24.9

27.9

24.1

15.7

13.6

16.9

27.2

43.6

28.3

16.1

8.7

10.4

2.6

7.3

6.4

9

2.5

8.5

4.2

1.2

5.5

13.7

69.8

88.9

97.4

106.8

97.3

68.4

979

17.1

21

6.9

5.5

4.3

1.3

4.5

5.6

4.3

15.8

3.5

8.7

4

1.3

0

18.6

54.2

29.5

4.6

9

15.4

11

33.5

0.6

30.2

60.6

37.2

35.1

15.8

27.4

28

514.5

36.1

58.3

16.3

8.1

24.2

16.7

24.7

11.3

23.5

44.2

42

34.2

23.1

5.2

1.7

0.4

7

6.6

26.9

4.8

25.8

10

0.4

2.8

26.3

57.3

103.2

114

26.6

58.4

75.4

915.5

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2008 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	44.8	41.6	6.2	69	59.1	14.1	39.2
13	73.1	73.9	60.6	19.4	75.9	76.9	23.3
14	36.4	25.3	1.5	15.4	27.1	4.1	29
15	116.3	60.4	21.5	34.2	34.8	19.9	33
16	79.3	139.9	119.6	48.1	122.6	175.7	76.6
17	157.3	157.7	117.6	156.8	238.6	133.7	124.7
18	192.8	187.5	135	42.9	105.6	162	69
19	133.7	35	90.9	99.5	83.7	79.4	136.9
20	70.3	62.6	30.2	98.6	31.7	56.9	8.7
21	14.4	25.2	8	27.6	15.7	25.4	22.9
22	3.4	0.6	8.9	3.4	0.5	6.5	3.6
23	7.2	3.4	3.4	6.2	0.6	3.2	5
24	0.1	0	0	0	0	0	0
25	1.4	0	0	0	15.9	0	0
26							
27							
28							
29							
30							
31							

74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
44.8	41.6	6.2	69	59.1	14.1	39.2
73.1	73.9	60.6	19.4	75.9	76.9	23.3
36.4	25.3	1.5	15.4	27.1	4.1	29
116.3	60.4	21.5	34.2	34.8	19.9	33
79.3	139.9	119.6	48.1	122.6	175.7	76.6
157.3	157.7	117.6	156.8	238.6	133.7	124.7
192.8	187.5	135	42.9	105.6	162	69
133.7	35	90.9	99.5	83.7	79.4	136.9
70.3	62.6	30.2	98.6	31.7	56.9	8.7
14.4	25.2	8	27.6	15.7	25.4	22.9
3.4	0.6	8.9	3.4	0.5	6.5	3.6
7.2	3.4	3.4	6.2	0.6	3.2	5
0.1	0	0	0	0	0	0
1.4	0	0	0	15.9	0	0

Total	1713 1278.3 872.2 1576.6 1542.4 819.7 1389.1

2147

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2008 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 4.2 0 0.9 0 0 6.3 0 9.9 0 0.8 0 0 1.2 0 11.9 0 0 0 0 0 0 3.4 0 0 0 6.7 4.9 34.5 39.4 0.8 0 3.4 31.7 4.2 0 4 0 0.4 0 1.8 3.1 2.5 9 0 0.5 1.6 0 3.8 0.9 8 0.6 12.4 1.1 1.4 35.7 0 2.3 0 0 0 0 0 0.6 2.8 0.2 6.4 0.4 4 9.7 2.9 21.1 1.4 1.2 20.6 5.9 2.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 0.3 0 0.2 0 0 0 0.2 0.2 0 0.2 0 0.2 0 0.5 0.6 0 0.3 0 0.7 0 0 0.7 0 0 5.7 0 0.1 0 0 8.3 0 0 0.6 0 0 0 0 0 0 0 0 0 0 0 0.2 2.4 0 0 1.6 0 0 0 0.3 0 0 0 0 0 2 0.6 0 0 0.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.8 0 0 0 0 0 0 0						

Total	49.3 120.8 3.1 25.2 32.7 59.8 73.6

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2008 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0	0	0.2	0
16	0.2	0	0	0	0	0.9	10.5
17	1.1	12.9	0	0	0	0	1.2
18	0	0	0.6	7.1	0	0	0
19	0	0	0	0	1.1	12.8	0
20	0	0	0	0	0	0.2	0
21	0	0	0.6	7.3	0	0	0
22	0	0	0	1.7	19.5	0	0
23 24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	7.1	0	0	0.6	0	0	0.4
16	0	0	0	0	1.6	18.1	0
17	0	0	0	0	0	0.6	7.2
18	0	0	0	0	0	2.1	23.7
19	0	0	0	0	0	0.4	4.8
20	0	0	0	0	0	0.5	0
21	0	0	0	0	0	0.3	3.1
22	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0

Total	0.2 0.4 7.1 16.7 195.2 0.6 0

2149

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2009 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2150

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2009 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2							
3 4							
5 6							
7 8							
9 10							
11							
12							
13							
14							
15	3.2	0.3	0.3	7.8	13.1	1.4	2.2
16	0	0.1	0	0	0	1.1	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22							
23							
24							
25							
26							
27							
28							
29							
30							

11.8	5.8	0.3	0.3	8.6	0.1	0.1	0
0	5.8	0	0.7	5.8	0.9	2.7	0
0	0	0	0	0	2.3	6.1	0
0	0	0	0	0	0	0	0
1.1	0	0	0	0	0	0	0
0.3	1.1	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0.2	0.7	0
0	0	0	0	0	3.3	0	1.9

3	0	0.3	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
5.6	0	0	0	0	6.9	3.6

Total	17.9 13.6 0.6 20.9 30.5 11.3 19.8

2151

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2009 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11							
12	0.5	0	0	0	0	0	0
13	5.5	2.9	0.5	2	2.1	3.2	8.8
14	76.5	7.6	16.3	43.1	280.5	211.6	186.4
15	14.8	7.9	25.7	4.1	24.9	4.6	4.2
16	0.7	2.4	0.1	0	0	0	0
17	2.3	3.8	0.2	0.3	20.9	1	0.5
18	15.3	37.4	6	14.8	12.2	4.5	15.4
19	4.5	37.3	1	8.2	7	3.7	88.3
20	4.7	7.6	6.1	8	7.8	12.8	5.2
21	6.1	19.7	7.8	33.9	15.1	20.1	8.4
22	27.8	7.2	35.2	24.8	44.3	73.6	18.6
23	45.3	7.6	49.4	22.4	45.9	49.1	18.7
24	14.7	5.8	9.1	2.1	3.3	8.7	3.2
25							
26							
27							
28							
29							
30							

Total	600.6 494.8 715.1 573.6 428.5 634.7 364.4

2152

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2009 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	5.5 8.3 0.7 10.8 15.9 7.6 12.8 5.9 10.2 3.8 17.5 11.1 9.6 15.7 10.1 6.9 0.3 6.6 17.3 2.3 18 29.4 41.3 3 31.5 57.5 5.6 37.3 12 13.1 10. 12 17.8 4.7 22.3 39.5 2.7 1.4 6.8 9.7 3.5 8.6 55.7 6.3 2.3 13.9 11 6.7 14.6 2 21.5 3.2 16 25.1 8.1 14.3 3.6 15.3 1.2 8.4 25.7 4.7 24 4.3 10.1 0.5 10.6 11.7 1.2 15.7 7.5 10.1 0.7 15.2 13.6 5.1 22.2 0.8 13.5 0.2 7.2 20.7 9.8 14.5 8.6 6.7 34.1 2.7 9 19.7 8.2 7.6 9 4.7 5 12.3 4.5 5.4 2.6 24.8 0.7 2.2 34.7 3 6.9 4.1 20.4 7.1 4.3 23.2 2.8 20.5 8 8.4 18.8 5.3 1.6 43.8 6.6 13.4 7.7 7.8 27.8 14.4 23.1 18.5 15.7 5.5 2.3 25.9 14.1 14.8 24.5 1.4 5.2 0.2 6.5 5.7 0 6.9 3.2 30.1 0.5 19.3 19.2 0 29.8 10.4 14.2 1.1 27.2 29.1 13 32.6 6.2 19.7 10.4 20.3 14.9 16.9 25.1 20.2 10.7 30.5 29.3 15.4 23.7 33.4 12.8 13.6 16.6 52.6 26 20.2 32.6 23.5 10 6.6 7.6 14.5 9.3 18.4 5.7 13.6 10.8 31.3 20.4 10.2 31.4 23.7 21.9 20.3 40.8 31.2 26.1 32.4 34.5 40.3 29.5 40.8 57.4 21.5 44.4 27.7 27.2 27.6 32.6 21.4 34.5 38.6 63.1 67.2 18.7 11.3 100.7 16.6 8.9						

Total	468.7 515.5 276.1 549.3 702.3 372.6 645.1

2153

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2009 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	35.9 22.9 60.2 30 22.7 93.1 33.7 29.4 40.2 41.8 17 26.6 33.7 16.6 178.1 89.1 248.6 57.6 16.2 365.5 26.8 25.6 25.4 21 12.8 10.6 20. 15.2 7.2 25.4 3.4 49.6 77.4 28 106.4 0.5 8.7 0.4 20.5 13.3 4.5 49. 2.6 1.2 0.2 9.6 6.6 2.2 8.8 0.5 3 8.2 3.7 0 5.1 7.4 20.3 0 3.6 0.4 0 1.1 2.6 0 1.9 0 0.2 0 0 1.1 0.1 0 0.1 4.1 0 0 6.4 0.3 0 0 3.3 0 0 11. 16 15.3 1.4 28.7 8.6 3.1 16.2 1.7 5.3 0 0 11.3 0 1.3 0.5 0 0 0 0 0 0 0.7 0 0 0 0 0 0 0.5 0 0 0 1 0 0 0 0 0 0 0.5 0 0 0 0 0 0 1.6 2.4 0 0 2 0 0 14.3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	319.9 240.6 388.9 237.5 210.7 559.8 303.5

2154

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2009 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0.2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0.9 0 0 2.9 0 0 0 0 0 0 0 0 8.1 0 0.2 0 0 0 0 0 0 0 0 0 0 3.5 11.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.3 (0 0 0 0 0 0 0 0 0 0 0						

Total	12 12.9 0.2 0 2.9 0 0.2

2155

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2010 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2156

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2010 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.4 0 0.9 0.5 0 0.3 0.2 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0.6 7.2 0 2.5 11.2 0 0 0 0 0 0 0.2 0 0 0 0 0 0 0 0 (						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.7 5.2 0 1.6 7.1 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.2 0.3 0 0.4 5						
21	13.5 0 2.4 5.1 0 0 0.6 0.6 0.2 0.9 0.8 1.1 1.8						
22 23 24 25 26 27 28 29 30							

Total	7.5 26.5 1.1 9.1 24.7 1.4 2.4

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2010 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	 7.7 0.2 12 3.8 1 3.2 2.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.5 0 7.1 0.4 13.4 2.6 0.7 6.2 1.2 34.4 1.9 47.3 40.6 11.8 37.1 19.2 1 0 1 0 0 0.2 0 0 0 0 0 0 2.6 4 13.2 32 2 28.1 52.9 2.9 13.2 3.4 5.3 0.8 8.9 13 33.9 31.2 0 0 0.3 0 0.8 34.6 10.9 40.8 28.5 59.2 27.1 22.1 150.8 47.7 83.7 59.2 76.8 125.7 72.2 125.3 76.8 51.9 30.3 50.1 76.3 45.4 23.6 61.4 77.4 58 46.5 136.6 82.1 48.6 85.7 40.6 38.1 26.7 60.8 40.1 34.9 34.2 34.6 14 36.9 38.1 24 22.4 21.5 9.5 13.9 8.5 7.5 10 18.4 7.4 11 0.7 15.5 14.9 4. 1.5 5.5 8 0.9 18.2 4.3 1.3 2.3 3 21 8.4 14.4 36.2 11.5 22.8 16.5 33 11.9 43.7 26.7 9.2 40 15.9 82.3 16.2 138.3 38.7 16.8 96.6 26 167. 23.9 233.5 83.6 28.8 184 49.9 36.4 14.4 52 36.3 12.7 87.3 27.3 6 4 4.6 8.2 8.7 10.5 6.4 3.8 0.8 2 6 2.3 3.5 2.8 22 3.4 31.6 13.9 6.8 35.1 25.8						

Total	796.8 366.4 935.3 824.9 478.6 1028.8 596.3

2158

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2010 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	28.7	51.7	17.9	33.8	42.1	29.5	31.1
12	34.3	28	24.6	23.1	44.2	36.4	20.9
13	80.1	20.1	16.5	5.1	49.9	22.1	9
14	9.5	16.2	3.5	17.7	10.1	7.3	11.7
15	11.7	9.8	11.5	15.6	11.9	12.3	10.4
16	17.6	52.4	57	19.7	42.6	28.3	8.7
17	17.6	11.2	2.8	57.7	7.2	28.9	18.7
18	31.2	12.6	24.5	16.7	51.5	33.2	10.4
19	53.5	14.4	16.7	25.6	119.8	48.2	86.7
20	14.4	6.6	3.7	14	5.8	8.1	0.8
21	16.7	5.6	22.4	12.7	2.5	18.2	7.3
22	14.3	19.5	0.4	32.7	9	2	14.2
23	25	3.8	30.9	12.4	7.6	29.9	7.2
24	7.7	13.5	10.8	10.1	27.5	9.3	15.5
25	7.3	12.7	23.1	3.9	7.6	11.5	44.4
26							
27							
28							
29							
30							
31							

Total	860.3 516 708.6 1191.4 653.4 781.9 733

2159

Date

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

Total

74°E

15°15'N

15°15'N

DAILY RAINFALL (in mm) AT DIFFERE N T GRID POINTS FOR THE MONTH OF

Year - 2010 : M onth - October

Year - 2 010 : Month - November

74°15'E 73°45'E 74°E 74°15'E 73°45'E 74°E Date 74°E 74°15'E 73°45'E 74°E 74°15'E

15°30'N

15°30'N

15°30'N

15°45'N

15°45'N

15°15'N

15°15'N

15°30'N

15°30'N

15°30'N

73°45'E

15°45'N

74°E

15°45'N

11.3

8.8

13.7

42.6

9.1

0.3

0.1

6.7

0

14

0

0

0

0.4

0.8

5.1

12

33.4

30.9

27.3

0

2.1

48.9

7.9

4.5

8.6

0

0

0

0

0.2

288.7

44.4

0

6.5

45.3

0.2

1

0.6

0.8

2.5

0.3

0

0

0

0

0

0.6

0.5

4.4

0.4

0.6

0

0.3

0.3

2.7

0.6

5.8

0

0

0

0

3.7

121.5

7.9

0.7

10.1

38.3

0.8

0.2

0.4

6.5

0

1.4

0

0

0

0.5

0.4

3.3

21.9

29.5

51.2

19.4

0

0.2

59

15.8

0.7

0.6

0

0

0

0

0

268.8

3.6

25.7

28.2

57.9

26.7

0.2

0

0.6

0

40.2

0

0

0

0

2.2

1.6

7.5

47.1

7.2

54

0

6.1

52.7

11.1

12.7

22.5

0.2

0

0

0

0

408

19.8

6.5

16.2

54.1

7.1

0.4

0

0

4.2

10.2

0

0

0

0

0.6

0.3

1.7

12.7

1.5

17

0.3

1.5

2

10.7

3.2

6.8

0

0

0

0

0.2

177

7.6

0

7.6

55.6

0.5

17.3

1.6

0.9

0

3.9

0

0

0

0.1

10.6

7.8

12.7

66.8

27.7

8.4

0

0

41.9

5.8

0.6

1

0

0

0

0

0

278.4

54.7

11.1

27.9

34.8

11.6

6.1

0

0

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17.7

0

0

0

0

4.8

1.5

3.2

42

6.1

23.6

0

2.9

20.7

1.5

7.6

19.2

0

0

0

0

0

297

1

2

3

4

5

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7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

Total

2160

5.1

0

0

14.5

9.4

6.5

5.4

6.7

56.9

3.1

17.8

20.2

12.1

0.5

8.6

7

0.4

0

0

4.4

0

0

1

2.1

2.2

0

0

0

0

0

183.9

25.8

0

4.7

10.1

10.5

2.5

0.7

10.5

42.5

1.3

3.2

23.7

1.8

3.1

16.4

6.4

2.1

0

0

0

0

0

0

7.2

3.3

0

0

0

0

0

175.8

0

0

0

16.6

8

2.9

1.1

2.3

62.7

3.5

6.8

6.7

1

1.5

6.3

11.4

0

0

0

0.4

0

0

2.5

0.6

0.2

0

0

0

0

0

134.5

0

0

0

7.9

13.6

15.4

15.6

11.9

59

2.3

43.4

41.3

35.3

0

2.6

3.3

0

0

0

12.7

0

0

0

0

5.2

0

0

0

0

0

269.5

2.9

0

3.1

2.4

7.9

4.4

3.9

12.2

29.4

0.7

13.1

25.7

14.5

5

11.2

4.2

0.2

0

0

3.2

0

0

0

0.7

4

0

0

0

0

0

148.7

0

0

0

28.6

7.1

10.1

21.4

1.4

34.6

4.5

18.1

1.8

0

6.7

1.2

17.3

0

0

0

0

0

0

0.8

4.4

3.6

0

0

0

0

0

161.6

0

0

0.2

11.7

6.1

10.7

9.5

5.2

34.3

1.9

19.2

17.8

25.1

9.1

0.9

2.1

0

0

0

5.5

0

0

1.2

0.6

2.7

0

0

0

0

0

163.8

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2010 : Month - December							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.2 1.2 0 0 0.1 0.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4.7 0 3 0.4 0 0.6 0 3.8 2.3 3.6 1.4 0.3 0.6 0.5 0						

Total	8.7 3.5 7.5 1.8 0.4 1.7 0.5

2161

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2011 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0						

Total	0 0 0 0 0 0 0

2162

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2011 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	15.6 9.7 18.1 0.7 4.1 33.2 3.7 0 0 0 0 0 0 0 0 0 0 0 0 0 1.7 2.9 2						
18	9 7.5 0 3 0 0 0.2 0 0 0.1 0 0.9 1.4 0 0 0.5 0 0 0 0 0 0 0 0 0 0.1 0						
19	1.1 0.6 0 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
22 23 24 25 26 27 28 29 30							

Total	18.2 14.1 20.7 10.8 12.7 33.3 7.1

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2011 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	2.9	3.2	9.3	2.1	5.2	5	0
12	31.5	26.7	30.3	21.6	43.6	40.5	41.3
13	92.2	47	38.8	45	20.9	45.3	44.3
14	19.2	23.8	20	11.6	15.5	16.7	14
15	67.9	64.3	49.2	76.5	71.2	113.5	69.7
16	75.4	44.3	56.7	35.1	97.5	76.3	88
17	35.6	28.8	65.3	41.4	32.3	41.4	43.8
18	30.9	24.1	140.9	110.2	79.9	66.7	87.7
19	74.5	114.5	89.1	56.9	50.1	68.4	46.9
20	15.9	9.2	2.3	8.9	0.7	1.8	2.7
21	13.3	20.4	38.5	12.1	98.6	70.7	49.7
22	33.5	53.7	137.2	134.8	50.2	101.2	115.2
23	14.1	7.8	13.1	92.3	105.6	63.7	106.3
24	38.5	35.2	6.3	53.4	1	7.4	0.7
25	5.7	2.3	3.1	3.9	2.5	3.2	2.3
26 27 28 29 30							

Total	1309.9 1309.3 862.2 1503.3 1405.3 1226.8 1085.4

2164

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2011 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	21.8	23.7	10.7	20.3	21.5	22.4	35.2
12	115.3	122.8	145.1	192.7	161.2	148	108.1
13	106.8	51	77.6	34.5	37.9	10.9	25
14	19.9	10.3	27.5	5.1	8.8	6.4	16.5
15	15.7	18.1	16.4	19	2.5	18.4	17.1
16	12.4	9.4	11.2	10.2	18.4	14.8	14
17	27.5	6.6	15.3	21.2	6	23.2	2.1
18	16.9	17.9	12.3	19.7	12	18.4	28.1
19	19.2	22.7	30.7	21.4	11	27.2	37.2
20	30.7	44.9	50.7	45.4	33.8	7	6.8
21	42.9	37.4	53.1	21.9	1	3	2.1
22	10.3	1.4	4.1	6.3	7	11.6	8.7
23	14.5	19	6.8	17.2	17.9	9.3	6.9
24	39.5	46	19.4	41.2	43	37.6	49.5
25	101.9	75.5	88.8	96.5	77.7	63.7	67.8
26							
27							
28							
29							
30							
31							

Total	894.6 992.3 787.6 1137.8 1060.2 940.7 917.1

2165

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2011 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0	0	0	0.4	0
15	0	0	1.2	0	9.3	5.3	0
16	1.3	4.5	0	0	0	0	0
17	13.8	4.4	14.4	7	7.4	2.1	12.7
18	18.7	8.9	9.1	0.9	6.5	9.7	3.2
19	0	0.2	3.4	6.7	13.4	0	25
20	8.4	4.8	0	3.3	0	0	1.6
21	0	0	0	0	0	0	0
22	0.9	0	0	9.9	9.8	13.7	6.5
23	2.7	1.9	1.3	0.5	0	0	0.2
24 25 26 27 28 29 30 31							

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13							
14	0	0	0	0	0	0.4	0
15	0	0	1.2	0	9.3	5.3	0
16	1.3	4.5	0	0	0	0	0
17	13.8	4.4	14.4	7	7.4	2.1	12.7
18	18.7	8.9	9.1	0.9	6.5	9.7	3.2
19	0	0.2	3.4	6.7	13.4	0	25
20	8.4	4.8	0	3.3	0	0	1.6
21	0	0	0	0	0	0	0
22	0.9	0	0	9.9	9.8	13.7	6.5
23	2.7	1.9	1.3	0.5	0	0	0.2
24 25 26 27 28 29 30 31							

Total	111.7 156 48.1 210.8 179.3 69.5 153.8

2166

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2011 : Month - December

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0						

Total	0 0 0 0 0 0 0

2167

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2012 : Month - February

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
16	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
17	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
18	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
19	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						
21 22 23 24 25 26 27 28 29							

Total	0 0 0 0 0 0 0

2168

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2012 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14							
15	0	0	0	0.9	1.5	0	0
16	0	0	4.7	0	0	0	0
17	0	0	0	2.3	1.9	0	0
18	3.7	0	0	1.6	0	0	1.4
19	0.4	0.1	0.2	0.6	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22 23 24 25 26 27 28 29 30							

Total	10.8 8 0.2 0.2 3.8 0.9 9.5

2169

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2012 : Month - June

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.6 0 0 0 0 2.4 1.2 0.9 0.3 0.5 0 0 37.2 27.7 56.2 9.1 19.9 38.9 6.9 24.4 28.8 61.3 37.2 33.9 40.9 22 43.5 44.5 20.8 48.1 46.8 9 18.1 29.8 18.8 4.4 2.6 10.3 14.7 1.4 8 8.4 0.9 1.8 4.6 0.8 1 13.5 15.2 3 4.3 9.9 30.7 4.7 3.3 3.4 4.5 5.6 5 1.4 4.6 16.5 11.5 106 14 14.5 69.6 11.5 1.3 2.1 19.7 1.6 1.9 12.5 1.9 26.7 17.8 14 15.6 16.1 11.9 7.1 28.9 12.7 14 7.5 12.4 12.9 4.9 49.8 23.2 14.9 19.3 22.3 16.9 9.1 100.7 86.8 43.8 39.2 64.9 56.7 21.9 101.9 105.3 177.4 186.6 146.6 269.8 160 121.6 91.5 200 33 62.5 128.8 24.1 46.6 44.9 16.4 24.1 32 33.2 24.6 7.8 11.9 6.1 24 13.9 12.5 22.9 14.1 8.2 5.9 9.6 19.4 2.2 3.5 4.6 11.1 4.3 4.4 4 2.3 49.9 25.2 36.6 27.2 27.4 32.5 14.2 106.5 105.2 80.8 91.4 101.4 100.7 47.7 82.6 58.1 8.7 36.9 47.4 32.1 37.8 53.5 49 49.5 46.9 48.1 81.6 26.6 22.5 21.1 41.8 47.8 36 35.7 22.9 35.3 37.2 62.9 46.1 45.5 26.4 19.5 75.2 72.5 78.1 126.4 100 138.2 70.7						

Total	1115.8 942.7 1142.6 907.5 942.1 1233.2 580.6

2170

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2012 : Month - August

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10							
11	8.9	12.7	5.1	27.9	20.1	16.1	36.1
12	83.5	97.8	77.5	131.8	117	99	103.9
13	13.7	19.4	4.8	50.9	34.5	15.1	64.7
14	47	74.3	25.9	93.9	79.5	50.3	56.9
15	60.2	61.6	35	58.2	57.3	37	35.7
16	63.1	73.4	106	86.5	48.2	89.9	34.1
17	42.1	44.8	17.3	31.8	35.2	13.2	19.2
18	6.7	0.3	5.3	5.6	3.2	3.5	6
19	10.2	6.3	5	24.3	32	12	34
20	33.5	11.2	21.9	25.3	5.3	11.4	18.1
21	4.5	3.2	3.2	2.9	1.4	0	0
22	2.1	14.6	3.7	24.6	30.9	32.4	35.7
23	50.1	93.6	21.7	57.7	51.9	25.6	71.6
24	37.4	43.3	41.4	27.8	22.4	21	25
25	17.2	15.9	3.8	6.2			
26							
27							
28							
29							
30							
31							

Total	839.3 932.2 651.1 1132.2 1022.3 792.1 902.3

2171

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2012 : Month - October

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	7.3 12.7 5.2 58.6 31.3 18.7 44.2 0.7 2.7 2.4 12.3 6.3 7.2 15.3 55.8 55.7 28.3 45.3 45.9 22.3 20.9 18.3 19.3 24.8 25.2 22.2 13.3 19.6 11.8 24.4 15.4 14 31.4 19.3 0.6 1.9 10.3 9.1 6 23.1 6.2 0 0.1 1.8 1 0.5 4.2 1.9 0 0 0 0 0 4.8 0 0 0.4 0 3.2 4.9 0 1.4 15.7 19.9 4.1 0.3 8.1 4.6 0.1 0 0 0 0 0 1.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.8 0 0.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.6 4 0 0 1.7 0 0 3.6 1.5 0 0.1 0.6 0 2.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	115.6 130 101.3 170.6 142.3 131.3 131.5

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M								
Year - 2012 : Month - December								
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	0 0							

Total	0 0 0 0 0.3 0 0

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M							
Year - 2013 : Month - February							
Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1.3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0.6 1.6 30.3 3.2 23.2 11.8 0.4 7.8 0.4 2.9 1.9 3.4 1.3 0 0 0 0 0 0 4. 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	13.4 9.7 2 33.2 5.1 26.6 17.8

DAILY RAINFALL (in mm) AT DIFFERENT GRID POINTS FOR THE M

Year - 2013 : Month - April

Date	74°E 15°15'N	74°15'E 15°15'N	73°45'E 15°30'N	74°E 15°30'N	74°15'E 15°30'N	73°45'E 15°45'N	74°E 15°45
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	0 11.4 (0 3.5 0 0.6 0 0 0 0 0 0 0 0 3.8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						

Total	0 15.2 0 0 3.5 0 0.6

2175

2176

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - XI

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – XI

Sl. No.

1.

D E S C R I P T I O N

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 – 2244

2245 - 2276

PAGE NOS

2.

Determination of water requirements

of the three Party States

- **Stateof Karnataka**

2277 - 2443

DECISION AND FINDINGS BY THE TRIBUNAL ON IMPORTANT QUESTIONS CONTD……

ECOLOGY:

924.

The Tribunal notices that the issues mentioned below relate to effect of diversion of Mahadayi River by the State of Karnataka and State of Maharashtra on ecology. They are closely interlinked with each other. Therefore, the Tribunal proposes to deal with them together and give answer to the same.

925.

Issues Nos. 5, 11, 16, 18, 19, 21, 22, 23, 30 and 32 are interlinked with each other and they are reproduced as under:

“5. Whether the State of Goa establishes that after assessing and deducting from the available waters of river Mahadayi required for ecological sustenance of the River valley eternally, specifically giving due consideration of the scientifically predicted global warming, sea level increase, increased salinity ingress in coastal areas, etc., the share of all the riparian States

should be determined on the basis of remainder water available from river Mahadayi?”

“11. Whether the State of Goa establishes that the equitable share of three co-basin States in the quantity

of water available from river Mahadayi should be adjudicated after taking into consideration the long term in-basin needs of the three States for the purpose of domestic water supplies, irrigation, hydro-power generation, navigation, pisciculture and environmental project?"

"16. Whether the State of Goa establishes that with the impact of global warming, saline water boundaries would be subjected to a dual mechanism of landward push, due to reduced fresh water flow on one hand and increased sea level on the other hand and also impact process of sedimentation if the proposed diversion is effected?"

"18. Whether the State of Goa establishes that the proposed diversion schemes of the States of Karnataka and Maharashtra will cause severe and irreparable damage and loss to the forests, wildlife, other organic life and bio-diversity stratosphere of the area in the Mhadei basin particularly in the upstream areas and

overall ecology of the Mhadei river basin?”

“19. Whether the State of Goa establishes that the proposed diversion schemes of the States of Karnataka and Maharashtra would severely result in destruction, exploitation, damage, diversion of habitat from the wildlife sanctuary and also diversion or stoppage of flow of water into and / or outside the wildlife sanctuary etc.?”

“21. Does the State of Goa prove that diversion of any kind by the State of Karnataka and the State of

Maharashtra of interstate waters of river Mahadayi by going against the natural flow of water will degrade and adversely impact the ground water flow Pattern, the tributaries and will affect the ecology of the Riparian as well as upper Stream areas?"

"22. Does the State of Goa prove that the biological hotspot of Western Ghat sustain and help to maintain global equilibrium of temperature and other ecological balance and that such a unique hot spot cannot be lost by permitting diversion of the interstate Mahadayi River water?"

"23. Whether the State of Goa proves that responsibility of maintaining the flow of water for aquatic and terrestrial ecology and environment in the Western Ghats in the State of Goa is not the sole the responsibility of the State of Goa and that the other co-riparian State of Karnataka and Maharashtra have an equal responsibility in that regard?"

"30. Whether the State of Goa proves that the States

of Karnataka and Maharashtra cannot undertake the works of the nature proposed, in an inter-state river, without undertaking any study, analysis, whatsoever in order to estimate the adverse effect of such projects on environment, flora, fauna, wildlife, fishing, agricultural activities, aquatic eco-system, within and outside the States of Karnataka and Maharashtra as well as have negative impact on the lower riparian State of Goa, and the flow of water into the inter-State river?”

2179

“32. Whether the State of Goa proves that Article 21 of the Constitution of India which is an Injunction against the State clearly specifies the duty on the part of the State of Karnataka and State of Maharashtra to undertake such Environment Studies to ensure protection of Ecological Environment, healthy living of the people likely to be effected within the basins of Mahadayi, inside and outside Karnataka including the riparian States of Goa?”

926.

The Tribunal finds that the effects of diversion of water by State of Karnataka and State of Maharashtra from Mahadayi River, on wild life, are mentioned, by the State of Goa in several paragraphs of its Amended Statement of Claims (Volume 131) i.e., paras 21, 21A, 21B, 21G, 27, 29, 33, 45, 56C, 58K, 154C, 160, 167, 169, 177C, 185, 190A, 190B, 190C(iv), 190C(v), 190C(vi), 190C(vii), 190C(xii), 190(xiii), 190C(xvi), 190C(xvii),

190C(xviii),

190C(xxi),

190C(xxii),

190C(xxiii),

190C(xxiv), 190C(xxv), 190C(xxviii), 190C(xxxiii), 207, 213, 224,

224D, 224E, 224I, 224K, 224M.

927.

As far as ecology is concerned, the relevant

paragraphs to be found from Volume No. 131, are 55, 56J, 56Y,

56ZE, 56ZQ, 58A, 58L, 58N, and 154C.

2180

928.

So far as effect on environment is concerned, the Tribunal notices that necessary averments have been made in paragraphs 57, 190C(vii), 204 and 206 of the Amended Statement of Claims (Volume 131).

929.

As far as effect of salinity ingress is concerned, relevant averments are to be found in paragraphs 178C(iii), 56, 56ZC, 56ZD, 56ZK, 56ZL and 203 of the Amended Statement of Claims (Volume 131).

930.

So far as adverse effects on fisheries are concerned, they are detailed in paragraphs 58, 58C, 58D, 58F, 58H of the Amended Statement of Claims (Volume 131).

931.

As far as Flora and Fauna are concerned, the Tribunal notices that the relevant averments are made in paragraphs 21C, 21E, 21F, 56ZQ, 154C(xii), 154C(xvi), 190C(xiv), 224 and 224A of the Amended Statement of Claims of the State of Goa (Volume

131).

932.

The measures taken by the State of Karnataka to

conduct Environmental Impact assessment Study for Goa region

in consultation with Government of Goa are mentioned in paragraphs 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.11, 2.12, 2.16, 2.17, 3.7 and 3.8 of Volume No. 129.

933.

The Tribunal notices that all the averments made in the above mentioned paragraphs, either by the State of Goa or by the State of Karnataka, have been dealt with, in great detail, while referring to their respective pleadings and, therefore, the Tribunal is of the opinion that it is not necessary to incorporate all the above mentioned paragraphs at this stage to avoid repetition.

934.

The Tribunal notices that regarding adverse effects or otherwise on the wild life, ecology, fisheries, flora and fauna, salinity ingress etc., the State of Goa has examined Shri Chetan Pandit as AW1, Shri Paresh Porob AW2, Dr. Shamila Monteiro AW3, Shri Rajendra P. Kerkar AW4 and Shri Subrai T. Nadkarni AW5, whereas the State of Karnataka has examined Prof. A.K. Gosain RW1 and Shri A.K. Bajaj RW2, in support of their

respective cases.

2182

935.

Shri Atmaram N.S. Nadkarni, the learned Senior Counsel, representing the State of Goa, has pointed out and relied upon evidence of AW2, AW3 and AW4, apart from drawing the attention of the Tribunal to the oral submissions made by him, which are to be found out on pages 56 to 68 of the Notes of Arguments of the State of Goa (Volume 237), to stress that there would be adverse effect on wild life, ecology, environment, fisheries, salinity ingress and flora and fauna, if the State of Karnataka and the State of Maharashtra are permitted to divert water from Mahadayi river. The learned Counsel has pointed out and relied upon the publication of Shri Paresh Porob AW2, a book on ‘Biodiversity in Goa’ in support of his arguments. According to Shri Nadkarni, the learned counsel for the State of Goa, the narration made in publication of Shri Paresh Porob identifies the water bodies, that the wild life is dependent on the water needs. It is pointed out that, Shri Paresh Porob has relied on study of International Union for Servicers of Nature, titled ‘Key Biodiversity Areas’.

936.

The learned Senior Counsel for the State of Goa has also relied upon portions of the evidence from the testimony of AW3 and AW4 as well as the Official Gazette of the Goa Forest

2183

Policy and maintained that the State of Karnataka is not entitled to any of the reliefs, since it has failed to discharge its burden on these issues, cast upon it and on the contrary, the State of Goa, through its witnesses, has been able to establish that, it would seriously suffer, if the State of Karnataka is permitted to proceed with the proposed obstruction of natural flow of waters in Mahadayi Basin.

937.

Shri Shyam Divan, the learned Senior Counsel representing the State of Karnataka, has argued that India is a complex environment regulatory regime comprising several Statutes and subordinate legislations in the form of Rules, Regulations and Statutory notifications, and the statutory regime is supplemented by large number of judgments rendered by the Hon'ble Supreme Court of India as well as the High Courts, in their respective public interest litigation jurisdictions. As a result, every new project in India is subject to a rigorous process of evaluation from the environment standpoint, before the project is commissioned. The learned Senior Counsel Shri Divan has

pointed out the relevant legislations and also the EIA Regulations and has contended that the EIA Regulations, envisage the process for obtaining environmental clearances in the following four

stages, broadly depending upon the categorization of project – (a) screening (b) scoping, (c) public consultation and (d) Appraisal. While elaborating his submissions, the learned Senior Counsel Shri Divan has maintained that the appropriate stage for assessing the environmental impact is not at the time of allocation of waters of an Inter-State River between the riparian States, but before the project is initiated. According to him, from environment perspective, India has a set of uniform laws and at the stage of evaluating environmental impacts, the State boundaries are not relevant and the impact assessment agencies will assess all impacts, both, within Karnataka and beyond that too, where a project is located within the State, which has a potential of affecting the environment of a neighboring State. Further, it is emphasized by him that on a proper appreciation of the Environment Regulatory Regime in India, the jurisdictional authorities who study the impacts on wild life, forests, fisheries, salinity etc., try to find out adverse impacts, if any, at the stage of granting clearances. What is emphasized by the learned Counsel Shri Divan is that having regard to these specialist functions and

duties, subject to appellate review, which will be carried out at a subsequent stage, it would not be appropriate for this Tribunal to

tu rn down the State of Karnataka's entitlement for a suitable allocation of waters of River Mahadayi for its beneficial uses.

938.

Shri Divan has further contended that first considering the involvement of an Inter-State River, there is need for clarity regarding the water allocation, amongst the Riparian States and once a Riparian State has secured an allocation of water, in the second stage, that State, say Karnataka, will approach the Regulatory Authorities charged with an environment protection, with a project proposal that mitigates environmental impacts. The learned Senior Counsel Shri Divan has explained that the third stage involved is scrutiny of the environment management plan, environment impact assessment studies etc., by the expert Appraisal Committee and clearances by the EIA Authority, whereas, the fourth stage, after appellate review, if any, will involve the execution of that project, incorporating all the statutory safeguards, to protect the environment, that are prescribed, as conditions in the environmental clearances. In support of his submissions, Shri Divan has relied upon number of

decisions rendered by competent Courts.

2186

939.

Shri D.M. Nargolkar, the learned counsel representing the State of Maharashtra, on environmental flow and other needs of the State of Goa, has especially pointed out that to the relevant issues and also relevant questions and answers given by AW2, AW3 and AW4, to maintain that the evidence of these witnesses establish that the of the State of Goa – (a) has not estimated the impact of global warming on water availability in Mahadayi Basin; (b) has not estimated quantity of losses in each project, due to increase in evapo-transpiration, direct evaporation from water bodies, reservoirs, canal surfaces, farms etc. (c) has not done any scientific study relating to sea level increase and increased salinity ingress; (d) has not undertaken in-

depth scientific evaluation of prioritization; (e) has not undertaken any study in respect of sediment flow; (f) has not conducted studies in respect of effect of diversion of water by State of Karnataka and State of Maharashtra on the agriculture of Mahadayi River Basin and the ground water flow pattern; (g) has not scientifically worked out the environmental needs; and has projected the needs for the State of Goa, without discounting for needs met with, from import of 261 Mcum from Maharashtra thereby accepting the augmentation of water in Mandovi Basin.

2187

940.

The learned Counsel Shri Nargolkar has placed reliance on what is stated at pages 49 to 65 of ARGUMENT NOTES BY THE STATE OF MAHARASHTRA (Volume 221), and has pointed out deficiencies in the evidence tendered by AW2, AW3 and AW4.

941.

The Tribunal is of the firm opinion that, in the light of the settled principles in relation to the environmental jurisprudence, there cannot be any dispute or controversy that the environment, ecology, forest, wildlife, etc. are to be protected. It is, no doubt, an established fact that, ecological disaster has to be avoided, prevented and the ecosystem, as such does not recognize any political boundaries. This Tribunal, need not overemphasize, the importance of the life, the health and the ecology and equally the importance of the water being essential to protect all facets of nature.

942.

In this regard the Tribunal finds that salutary

principles have been laid down in Articles 48, 48A and 51A(g) of the Constitution of India. These Articles are reproduced herein below:

“48. Organisation of agriculture and animal husbandry- The State shall endeavor to organize agriculture and animal husbandry on modern and scientific lines and shall, in particular, take steps for preserving and improving the breeds, and prohibiting the slaughter of cows and calves and other milch and draught cattle.”

Whereas Article 48A reads as:

“48A. Protection and improvement of environment and safeguarding of forests and wild life - The State shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country.”

And Article 51A(g) reads as under:

“51A. Fundamental duties – It shall be the duty of every citizen of India –

(g) to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for

living creatures;”

943.

In Subhash Kumar Vs. State of Bihar AIR 1991 SC 420, (1991) 1 SCC 598, the Hon’ble Supreme Court of India has firmly ruled that Articles 14-21 and 51A(g) must be read together. What is relevant to notice is that in M.C. Mehta Vs. Union of India (1992) Supp. (2) SCC 85 (633, 637), a law is laid down by the

2189

Hon’ble Supreme Court of India that duty under Article 48A can be enforced through a letter based on Article 21.

944.

Article 48 consists of two parts – the first part enjoins the State to “endeavor to organize agricultural and animal husbandry” and that too on modern and scientific lines. The emphasis is not only on ‘organization’ but also on ‘modern and scientific lines ’.

945.

Article 48A deals with “environment, forests and wild life”. These three subjects have been dealt with in one Article for the simple reason that, the three are interrelated. Protection and improvement of environment is necessary for safeguarding forests and wild life, which in turn protect and improve the environment. Thus, forests and wild life are not only clearly interrelated and interdependent, but they protect each other. Article 48A mandates that the State shall endeavor to protect and improve the environment to safeguard the forests and wild life.

946.

Article 51A(g) of the Constitution enjoins that it shall

be the duty of every citizen of India, inter alia, to protect and

improve the national environment including forests, lakes, rivers, wild life and to have compassion for living creatures. These two Articles, are not only fundamental in the governance of the country, but also, it is the duty of the State to apply these principles in making laws and further these two Articles are to be kept in mind in understanding the scope and purport of the fundamental rights guaranteed by the Constitution, including articles 14, 19 and 21 and also the various laws enacted by the Parliament and the State Legislatures. The provisions of article 48A of the Constitution are required to be construed as a part of the principle contained in Article 21 of the Constitution. A statute may not be ultra vires to Article 48A itself, if it is not otherwise offensive to Articles 14 and 21 of the Constitution. In Subhash Kumar (supra), read with Article 51A(g), 14 & 21, the Hon'ble Supreme Court has drawn the following conclusions:-

"(a) It is a constitutional duty not only of the State but also of every citizen to protect and improve the environment and natural resources of the country;

(b) Though neither Article 48A nor Article 51A is

judicially enforceable by itself, it becomes enforceable through the expanding interpretation of article 21, so that in case of a failure of the foregoing duties, the Supreme Court or a High Court, would entertain a

petition under Article 32 or 226, as a Public Interest Litigation brought by any individual or Institution in the locality or any social action group, even by letter."

947.

The natural resources of air, water and soil cannot be utilized, if the utilization results in irreversible damage to environment. There has been accelerated degradation of the environment primarily on account of lack of effective enforcement of environmental laws and non-compliance with the statutory norms. Constructing of dams or diversion projects are hazardous in nature. They impair the ecology and people's right to natural resources. The entire process of setting up and functioning of dams, reservoirs, water basin transfer projects, require utmost good faith and honesty on the part of those who propose those constructions. Such constructions have a tendency to degrade environment and is likely to affect air, water and soil and impair the quality of life of inhabitants of the area. Therefore, fullest disclosures including the potential for increased burdens on the environment, consequent upon possible increase

in the quantum and degree of pollution, has to be made out, at the outset so that the public and those concerned including the authorities, may decide, whether the permission can at all be granted for carrying on such big constructions. When questioned,

the regulating authorities have to show that, they acted in the manner enjoined upon them. Where they, either connive or act negligently by not taking prompt action to prevent, avoid or control the damage to environment, natural resources and people's life, health and property, the principles of accountability for restoration and compensation have to be applied.

948.

Having noticed the salutary objects of Articles 48, 48A and 51A(g) of the Constitution, this tribunal proposes to consider the issues which have been referred to earlier.

949.

Shri Chetan Pandit, AW1, in reply to question No. 117 has stated as under:

"… there are certain major differences between the Cauvery and Krishna on one hand and the Mahadayi on the other. The two most important differences are, in Mahadayi basin there are four wild life sanctuaries and one bird sanctuary within a very small area of about 2032 Sq. Kms. Second, the Cauvery and Krishna basins

already have a lot of human interventions and river valley projects. In contrast the Mahadayi basin is what hydrologists call a virgin basin. It is in Western Ghats which are identified as a hot spot of bio-diversity of global importance. The panel appointed by the Ministry of Environment and Forests under the

Chairmanship of Prof. Madhav Gadgil went to the extent of recommending a blanket ban on all water resources projects in Western Ghats and particularly and specifically recommended against any diversion of water from one basin to another. Thus, it would be seen that Mahadayi basin is in no way comparable to Krishna or Cauvery."

950.

On the aspects of ecology, question No. 178 was put to Shri Pandit i.e. AW1. The question and the reply are as under:

"Q.No.178. At Para 66, page 27 of your Affidavit, you have suggested that a "detailed study needs to be carried out of the ecology of the Mandovi river valley and its dependence on the river flow for its sustenanc e". You have not mentioned as to who should carry out the study suggested by you. Please tell us how the suggested study would help in better assessment of the water availability of the basin.

Ans. The water availability in the basin means the total

water available on 75% or 50% dependability basis in a scenario of no human intervention. This is to be determined by a hydrologic study and that study has been made and submitted. A certain quantity of water from the total water available will have to be reserved for ecology and environment. This quantity will have to be determined by conducting an ecological study. Several different methods have been proposed by different researchers and I have briefly outlined some of them in my affidavit. However, all these methods

can only indicate how much water will be required to achieve certain environmental objectives; or conversely indicate what might be the environmental impact for a given quantity of water reserved for the environment. Eventually a decision will have to be taken by an appropriate authority as to the environmental objectives to be achieved and accordingly, that authority will have to decide the quantity of water to be allocated for achieving these objectives, at various places in the river. In my affidavit my objective was to lay the foundation for establishing the importance of environmental flow. However, suggesting any particular agency for carrying out the environmental study was beyond my scope."

951.

It is also noticed by the Tribunal that AW2 Shri Paresh Porob, has deposed on the aspects of wild life forests and flora and fauna. This witness has reiterated the contents of his affidavit dated 11.11.2017, which was signed on 14.11.2017

(Volume No. 209), including Annexure A (Colly). This witness has also filed Additional Affidavit with additional material on 17.11.2017 (Volume No. 214).

952.

AW2, in his elaborate affidavit and additional affidavit has stated that he had been Associated with the forests of Mahadayi since 1989, i.e. even before its declaration as a Wild Life Sanctuary in 1999 and that during his quest for wildlife

observation, he had been exploring the Mahadayi Forest area and had carried out various graphic media documentation of the rich biodiversity in the area. After referring to para 13 of the National Forest Policy 1988, the witness has stated that International Union for Conservation of Nature has identified Bhagwan Mahaveer National Park and Madei Wild Life Sanctuary as

Bio diverse areas in India. According to him, the criteria adopted for this identification are – (i) Threatened Biodiversity, (ii) Geographically restricted, (iii) Ecological integrity, (iv) Biological processes and (v) Irreplaceability, which show that both the wildlife sanctuaries situated in Goa, are internationally recognized and are heritage sites of our country. In para 21 of his additional Affidavit-in-Evidence (Volume 214) the witness has, in terms stated that the proposed diversion, will reduce the flow in River Madei and as a result of this, there will be complete drastic adverse effect on the ecology, wild life and flora and fauna. The Tribunal notices that, on these aspects, this witness has not been cross-examined by the State of Karnataka and therefore, the

evidence tendered by the witness relating to adverse effect on wild life etc. will have to be accepted by the Tribunal.

953.

Relevant questions put to the witness Shri Paresh Porob, in his cross-examination, are 2, 4, 13 and 23. Therefore, the said questions with answers are quoted herein below:-

“Q.No.2. You have also deposed in your affidavit on the subjects of tidal back-water flow and salinity in para 48 and Mangroves in para 25. These matters relate to river ecology or aquatic environment. Is that right?

Ans. Yes , it is correct.”

“Q.No.4. The availability of water in a stream varies from season to season and also from year to year and species. Therefore, the Flora and Fauna have inherent biological character of adaptability to the changing water regime. What do you say?

Ans. Yes, I agree.”

“Q.No.13. The wildlife habitat in the Madei Wildlife Sanctuary depends upon the water not only from Mahadayi river but also from several streams and

nallahs which flow in Madei Wildlife Sanctuary. Is that right?

Ans. Though Madei Wildlife Sanctuary has several monsoon fed streams apart from Surla and Mahadayi, but most of the other streams go dry after the monsoon and wildlife habitats of Madei Wildlife

Sanctuary entirely depends on Surla and Mahadayi rivers."

"Q.No.23. I show to you a copy of the Berlin Rules on Water Resources, framed by International Law Association, Berlin Conference (2004). In Article 22, it is stated that "States shall take all appropriate measures to protect the ecological integrity necessary to sustain ecosystems dependent on particular waters". In Article 7, it is stated that "States shall take all appropriate measures to manage waters sustainably". Further, in the commentary, it is specifically mentioned that – "The recognition of sustainability as a basic principle of international water law thus is essential to assure the effective balancing of development against important social, environmental, and ecological values". However, in your affidavit concluding in Para 58, you have stated that " any sort of diversion, obstruction or aberration will result in adverse impact on six wild life sanctuaries

and will disturb ecological balance. …" I, therefore, put it to you that the conclusions are wholly contrary to the concept of sustainable development, because instead of balancing between the development and protection of aquatic environment, you have been advocating an extreme argument in favour of maintenance of natural flows in the river (para 57 of the affidavit). What do you say?

(PER TRIBUNAL: The learned counsel for the State of Karnataka has handed over a copy of the FOURTH REPORT prepared by International Law Association BERLIN CONFERENCE, (2004), WATER RESOURCES

LAW. The aforesaid document is taken on record and marked as MARK/KA-16).

Ans. I have not gone through these Rules and, therefore, I will stand by my affidavits as environmental stability is most important for having eco-centric approach towards conservation and not anthropo-centric. The eco-centric approach includes eco-systems, flora, fauna and humans, whereas in anthropo-centric approach humans are given priority above flora and fauna, which can have devastating effect on environment.

However, I may add that although I am not aware of these Berlin Rules, referred to in the question, as stated by me above, but for my affidavits I have relied upon National Forest Policy of 1988, annexed as Annex. C and National Bio-diversity Action Plan, 2008, annexed as Annex. E. These two policies have been framed by Government of India."

954.

A specific question No. 6 was put by the learned Counsel for the State of Maharashtra to this witness which is as under:

“Do you agree that any sort of diversion or utilisation by any of the States, including the State of Goa, in future, in Mahadayi basin would result in adverse impact and would disturb the ecological balance, resulting in total disaster in Mahadayi basin?”

2199

The answer given by the witness was as under:

“Yes, I agree.”

955.

The question No. 3 put to this witness by this Tribunal was and answer given by him are reproduced as under:

“Q.No.3. At Para 13, page 10 of your Affidavit dated 11.11.2017 (Volume 209), you have stated as under.

“I state that as forest officer we were made aware of National Forest Policy 1988 which clearly states “that the principle aim is to maintain environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms including Humans”. The National Forest Policy also states that derivation of direct economic benefit should be in sub ordinated to this principal aim. I state that if proposed project for diversion of Madei River waters

is allowed, it will be harmful to the ecology.
Further, it will also adversely affect the
Wildlife Sanctuaries and in general, it will
also definitely defeat the principle aim of
the National Forest Policy 1988."
We find that the principal aim (and not the principle
aim as stated by you in your affidavit) of the National
Forest Policy 1988 (already on record as MARK-

GOA/16(Colly)) has not been correctly quoted by you. The Para 2.2, which is part of the Para 2. BASIC OBJECTIVES, states as under:

"2.2 The principal aim of the Forest Policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms including human, animal and plant. The derivation of direct economic benefit must be subordinated to this principal aim."

It must be appreciated that the statements and provisions of any policy are to be seen in totality after due consideration of all aspects. We find that Para 4.4.1 of the National Forest Policy 1988, inter-alia, states as under:

"… Diversion of Forest land for any non - forest purpose should be subject to the most careful examinations by specialists

from the stand point of social and environmental costs and benefits. Constructions of dams and reservoirs, mining and industrial development and expansion of agriculture should be consistent with the needs for conservation of trees and forests. Projects which involve such diversion should at least provide, in their investment budget, funds for regeneration/ compensatory afforestation.”

2201

Obviously, the National Forest Policy 1988 lay due emphasis on careful examination of various projects of social needs from the stand point of social and environmental costs and benefits. Such projects, inter-alia, include dams and reservoirs.

Please tell us whether you examined the social and environmental costs and benefits before arriving at the conclusion that ‘if proposed project for diversion of Madei River waters is allowed, it will be harmful to the ecology’ and that ‘it will also adversely affect the Wildlife Sanctuaries and in general, it will also definitely defeat the principal aim of the National Forest Policy 1988’. If yes, please tell us the details and the Para of your Affidavit, where such details are furnished. If not, why such issues were not examined in accordance with the provisions of Para 4.4.1 of the National Forest Policy 1988?

Ans. The Government of Goa has notified various wildlife sanctuaries along the stretch of Western Ghats

of Goa, for water security and maintaining ecological balance. The socio-economic conditions of the inhabitants of these areas are dependent on Western Ghats in Goa. In my earlier Affidavit, dated 11.11.2017(Volume 209), para 46, page No.27, I have stated about man-animal conflict and its implications on the socio-economic condition of the people. The water flowing out from the wildlife sanctuary is being utilized by people for cultivating in a traditional practice which is mentioned at para 55 at page 31 of my Affidavit, dated, 11.11.2017.

2202

While preparing my two Affidavits I was conscious of
the National Forest Policy, 1988."

956.

AW3, Dr. Shamila Monteiro, on behalf of the State of Goa has deposed on the aspects of fisheries. She has specifically stated that the rivers/estuaries act as natural nursery grounds and any adverse impact can have far reaching consequences on the pelagic and demersal fisheries. According to her, Mahadayi River System is divided into two major ecosystems i.e. (a) complete fresh water ecosystem from the source up to Ganjim and (b) estuarine ecosystem from Ganjim up to the mouth of the river. She has further mentioned that during the non-monsoon period, the lower estuaries of both Mandovi and Zuari become an extension of the sea due to tidal sea water intrusion. According to her, after the withdrawal of monsoon, runoff decreases rapidly and by November it reaches negligible levels, which results in a large horizontal salinity gradient from Mandovi-end to the Zuari-end. She has pointed out that fresh water diversion will adversely affect the nutrient rich mangrove area, which in turn will affect

the survival of juvenile fish, bivalves and decapod crustaceans which will have a negative impact on the marine fish catch, shrimp industries and shell fish breading.

2203

957.

The witness has also pointed out that diversion of fresh water inflow is likely to alter the velocity of the flow of the river, thereby causing a change in the transportation pattern of sediments into an estuary and coast, leading to either erosion of banks/shoals or promote deposition of sediment along the banks and in the river. She has claimed that in order to maintain the fisheries biodiversity, in the present condition, the quantum of water required is 104.928 tmc during the wet season and 1.752 tmc during the dry season and that an amount of 52.464 tmc is required during the wet season whereas 0.876 tmc during the dry season is required to maintain the fisheries biodiversity in a moderate condition.

958.

After giving all the relevant particulars and facts, Dr. Monteiro has concluded, in para 76 of her Affidavit-In-Evidence dated 11.11.2017 (Volume 210) that, the abstraction and diversion of water from basin will cause a change in the

environmental factors, which will result in genetic fragmentation, habitat loss, loss in endemic species, recruitment failure. Change in trophic interaction thereby impacting fisheries production and in turn negativity influencing the livelihood of the fishers. This

aspect of her testimony, could hardly be challenged effectively, by the State of Karnataka.

959.

This witness was cross-examined by the learned counsel for the State of Karnataka. Question Nos. 1, 10 and 15 put to the witness are relevant for this purpose and, therefore, the said questions with answers, are reproduced as under:

“Q.No.1. According to you, as stated in you r Affidavit dated 11.11.2017 (Vol. 210), at para 76, page 27, “The survival of western Ghats and the continuity of fresh water flow are essential to sustain the rich aquatic biodiversity,...”. Are you referring to aquatic biodiversity in the context of Mandovi Estuary?

Ans. No, not only the Mandovi Estuary, but I mean the entire Madei River System.”

“Q.No.10. Have you made any scientific study with regard to the contribution of each of these estuaries in Goa on the fish production, and if so, what is the percentage of contribution of Mandovi estuary in the

total fish production in Goa?

Ans. We do collect the fish catch data of all the estuaries in a scientific manner as per the method of Central Marine Fisheries Research Institute (CMFRI). I have given the data of the fish catch in my Affidavit dated, 11.11.2017, at para 73 at page 25. Since this

matter pertains to the Madei river and not to the other rivers, I have not produced the data of other estuaries."

"Q.No.15. Would you please refer to Volu me-1 of the Master Plan of Goa (Annexure-120 of Vol.31) and turn to page No.55, para 5.6.4. The water requirement for salinity control in the estuary is mentioned as 158 Mcum (5.58 TMC). Therefore, the estimation made in the Master Plan is on the liberal side compared to what is calculated by the State of Karnataka in its Worksheet, MARK-KA/17. Therefore, you should at least accept, what is stated in the Master Plan. What do you say?

Ans. The Master Plan, Volume-I, GOA, was made in the year 1999 and therefore the figure mentioned therein does not relate to the salinity required by the aquatic bio-diversity, because perhaps at that point of time, the aquatic bio-diversity may not have been considered."

960.

AW4, Shri Rajendra P. Kerkar, is examined on behalf of the State of Goa to depose as an expert witness on environment, ecology and forests. His Affidavit and Additional Affidavit are Volume 211 and Volume 216 respectively.

961.

AW4, Shri Rajendra P. Kerkar, is examined on behalf of the State of Goa to depose as an expert witness on environment,

ecology and forest. He has filed Affidavit-in-Evidence dated 14.11.2017 (Volume 211) and has produced documents along with said Affidavit. Those documents form part of Volume 212. The witness has further filed Additional Affidavit-in-Evidence on 20.11.2017 (Volume 216). According to this witness, he had visited the site where construction work pertaining to the interconnecting channel at Kankumbi was done, by the Karnataka Neervari Nigam Ltd., which is designed for diverting the flow of Mahadayi River from Kalasa Nala and its tributaries to Malaprabha reservoir. According to him, he was monitoring the said work, right from the Project's Foundation Stone Laying Ceremony, which was held on 02.10.2006, till the date of his filing of Affidavit. According to him, it has come to his knowledge, through information obtained through several RTI applications, filed by him that the State of Karnataka has not obtained necessary statutory permissions and necessary clearances under Environment Protection Act, forest clearance and clearance under Wild Life Protection Act, but, has brazenly continued with, environmental degrading construction of the interconnecting

channel at Kankumbi till mid June, 2017. This witness has asserted that the construction mentioned above has resulted in large scale destruction to the environment and that the State of

Karnataka had not undertaken proper environmental impact assessment study, before embarking upon the construction of such a large scale project. What is stated by the witness is that on account of the work already carried out, an extremely large forest cover area is destroyed on account of felling of trees. After asserting that he himself has gone through the pleadings, studies, submissions, applications, replies and various reports, submitted by the experts before this Tribunal, including the issues framed by the Tribunal, the witness has stressed that in case any portion of Mahadayi River flow is diverted, as planned by the State of Karnataka, by constructing a dam at Kalasa and/or reducing the inflow into Surla River, the swamps will dry. According to him, the place, where Karnataka Government has undertaken the work of Kalasa Canals in Kankumbhi, has been identified as ecological sensitive area by Western Ghats Ecology Expert Panel and that Karnataka Government violating the norms of environmental laws has undertaken the work of Kalasa Project since 2006. The witness has mentioned that out of nine rivers and their several tributaries, river Mandovi is the only one that fulfills the needs of

maximum requirement of water for the State of Goa, whereas the rest of the rivers, have high level of salt water intrusion. The witness has emphasized that fresh water disputes, in the State of

Karnataka, have been caused due to fall in water level, on account of loss of forest cover, ecological degradation and faulty management of water resources. The witness has informed that if the plans of upstream diversion during Monsoon, by upper riparian States of Karnataka and Maharashtra are implemented, the total flushing time will drastically increase and the situation explained in a research paper, published by one reputed scientist of National Institute of Oceanography on the subject of Estimation of Flushing Time in Monsoonal Estuary, will really come true, which, in turn, will deteriorate the health of estuary with irreversible consequences. According to him, it is painful to notice that mankind has taken control of the water in the river and environment has been reduced to begging for some water. The witness has maintained that the term ‘minimum flows’ is used which is worse because it reveals a mindset of allowing ‘maximum abstraction’. Ultimately, the witn ess has made few recommendations to maintain ecology, forests, flora and fauna etc.

962.

This witness was also put question Nos. 7 and 14 on behalf of the State of Karnataka and, therefore, those questions as well as their answers are reproduced as under:

“Q.No.7. If you are given a choice between providing water to human beings and providing water to animals, how will you determine your preference?

Ans. My first priority will be for environment and I will make my best attempt to look the interest of animals first, and then if water is available, I will make attempt to provide water for human beings. If the environment is protected, then the same shall take care of human needs also.”

“Q.No.14. You have specifically admitted in para 12 (page 18) of your Affidavit dated 11.11.2017 (Vol. 211) that “I have no enough expertise for verifying the intricate mathematical calculations”. Therefore, I put it to you that you have neither an expertise nor competence to choose and operate a software for calculating the e-flow, and in any case the e-flow calculated by you, which comes to 36.8% of the Mean Annual Flow as stated at page 41 of your said Affidavit, is highly excessive and unreliable. What do you say?”

Ans. I deny the suggestion. Actually the Mean Annual Flow calculated by me pains me a lot. I want priority to be given for nature and environment. I have already dealt with this aspect of the matter in paras 36 and 37 of my aforesaid Affidavit, as well as earlier portion of para 12."

963.

During the course of cross-examination of Shri Rajendra P. Kerkar, AW4, the expert witness on behalf of the

State of Goa on environmental issues on 23.11.2017, when confronted with the questions on minimum flows required for environment and river ecology, he replied on the basis of a publication of IWMI but conveyed his complete ignorance about the MoEF & CC guidelines. The relevant questions put to AW4, the expert witness for the State of Goa, by the Tribunal and his answers are as hereunder:

“Q. No. 3. At Para 3 7, page 37 of your Affidavit dated 11.11.2017 (Vol. 211), you have mentioned about a research work done by V Smakhtin and M Anputhas, working in the International Water Management Institute (IWMI), and published as Research Report 107 ‘An Assessment of Env ironmental Flow Requirements of Indian River Basins’. It appears that findings of the above mentioned Research Report 107 are the basis for your Recommendations 2, 3, and 5 on pages 39 to 41 of your Affidavit dated 11.11.2017 (Vol. 211). Have the findings of the Research Report 107 of IWMI been critically examined and accepted by the Ministry of

Environment and Forests & Climate Change?

Ans. As per my knowledge and information, the findings of the Research Report 107 of IWMI has not been examined and accepted by the Ministry of Environment and Forests & Climate Change.

Q. No. 4. The Section on ‘Conclusions and the Way Forward’ of the Research Paper 107 of IWMI, inter -alia

states as under. [Ref: Page 255 of your Affidavit dated 11.11.2017 (Vol. 212), “The s tudy has effectively not been supplied with observed flow data of reasonable amounts and quality. The data which have been acquired and used were primarily from publicly available sources (Internet) where data are outdated and no conclusions on the accuracy or even origin of the data could be made. If the situation with access to data in India is not changed, any further EFA will be largely speculative. …”

How the results of such study can be considered as reliable and recommended to be adopted for application?

Ans. The results derived by using global flow data base and by using e-flow calculator helps to get reliable data as per my knowledge.

Q.No.5. We hand over to you the relevant pages of a document issued by the Ministry of Environment, Forest and Climate Change, in April 2015, titled as

“Standard Terms of Reference (TOR) for EIA/EMP Report for Projects/Activities Requiring Environmental Cl earance under EIA Notification 2006”.

We find that on page 48 of “Standard Terms of Reference (TOR) for EIA/EMP Report for Projects/ Activities Requiring Environmental Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015, there is specific mention about environmental flow release as under:

2212

“ - Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge.

- A site specific study on minimum environmental flow should be carried out.”

Why have you not considered the above mentioned guidelines included in the “Standard Terms of Reference (TOR) for EIA/EMP Report for Projects / Activities Requiring Environmental Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change?

Ans. I am not aware about the guidelines mentioned in the document, MARK-37 and, therefore, I have no comments to offer.”

964.

This witness was cross-examined by Shri D.M. Nargolkar, the learned counsel for the State of Maharashtra. In the said question the case of Maharashtra was put to him and, therefore, it would be interesting to reproduce Question No. 1 put to the said witness on behalf of the State of Maharashtra and answer given to the said question by the witness:

2213

“Q. No. 1. I put it to you that your claim, that the diversion of 2.83 TMC by the State of Maharashtra outside the Mahadayi basin, would result in irreversible damage to the environment and would destroy the rich habitat and further disrupt its ecological balance, is incorrect and without any basis. What do you say?

Ans. I deny the suggestion.”

965.

Shri S.T. Nadkarni, AW5, in his Affidavit-in-Chief, refers to the Affidavit-in-Evidence of AW4 in relation to environmental concerns. This witness has provided the requirements of the claims of State of Goa in relation to the Wetlands. This witness was cross-examined by the Tribunal and question Nos. 8, 13, 14, 15, 16 and 17 put to him by the Tribunal are relevant for the purpose on hand. Therefore, those questions and their answers are reproduced herein below:

“Q.No.8. At Para 23, pages 43 -44 of Annexure II of your Affidavit dated 14.11.2017 (Vol. 208), you have stated

as under.

“… The global warming and climate change are expected to impact the irrigation water requirement in several ways. Because of

increased atmospheric temperature the eva transpiration will increase, and the losses by direct evaporation from water bodies, reservoirs, canal surfaces and farms will also increase. …"

We observe that you have indicated about the likely impact of global warming and climate change on irrigation water requirement. However, you have not at all mentioned about the impact of global warming and climate change on the overall water availability of Mahadayi basin.

In this regard, please answer the following.

a. What are the likely impacts of global warming and climate change on water availability of Mahadayi basin and the quantity of likely increase or decrease in the waters of Mahadayi basin, say by 2050AD?

b. What is the estimated quantity of the losses due to increase in evapo-transpiration, direct evaporation from water bodies, reservoirs, canal surfaces and

farms, etc.?

Ans. I will answer this question in two parts.

a. Though there would be impact of global warming on the water availability in the Mahadayi basin, the State of Goa has not estimated the same.

b. The estimated quantity of losses in each project, due to increase in evapo-transpiration, direct evaporation

from water bodies, reservoirs, canal surfaces and farms, etc. has also not been estimated."

"Q.No.13. Has the Government of Goa carried out any scientific studies related to sea level increase and increased salinity ingress in coastal areas of Mahadayi river with due consideration of the scientifically predicted global warming? If so, what are the findings?

Ans. No such scientific study has been conducted by the Government of Goa."

"Q.No.14. Have you undert aken in-depth scientific evaluation of the issue of prioritization of various uses of water with due consideration to social, economic and environmental aspects, and particularly in the context of prioritization among in-basin uses and utilizations through extra basin diversions? If such in-depth scientific evaluation has been undertaken, what are the findings thereof?

Ans. The in-depth scientific evaluation of prioritization has not been undertaken by me but the prioritization

will be followed as per the National Water Policy 2012 or any other policy in force at the relevant time."

"Q.No.15. Has the Government of Goa examined and conducted any scientific studies related to impact of reduction in flow in river Mahadayi, if any, on the process of sedimentation? If such studies have been conducted, what are the findings thereof?

Ans. The State of Goa had commissioned a Study through DHI. However, due to lack of data on sediment flow in the river, the study on sedimentation could not come to a logical conclusion."

"Q.No.16. Has the Government of Goa examined and/or undertaken scientific studies about the effect of diversion of water by States of Karnataka and Maharashtra on the agriculture of Mahadayi River Basin in the State of Goa? If such studies have been undertaken, what are the findings thereof?

Ans. No such study has been conducted by the State of Goa."

"Q.No.17. Has the State of Goa commissioned any scientific studies regarding the impact of diversion of water by States of Karnataka and Maharashtra on the ground water flow Pattern? If such studies have been commissioned, what are the findings thereof?

Ans. No such study has been conducted by the State of

Goa, through any external agency. However, the Water Resources Department of the State of Goa had analyzed some of the effects at its own level."

966.

Prof. A.K. Gosain, who is examined as RW1, on behalf of the State of Karnataka was put question No. 307 which is relevant for the present purpose. The said question and answer given by the witness to the same are reproduced herein below:

“Q. No. 307. Did you while preparing 3 different Reports within a span of less than 20 months (namely your Reports dated 12th September, 2015, 15th November, 2016, and 11th May, 2017), consider or take into account, factors such as utilizable yield, dependency of the State of Goa on the water coming from the upstream of Mahadayi region, presence of thick and dense forestation, presence of 6 Wild Life Sanctuaries (the fact that the river passes through the Mahdei Wildlife Sanctuary, Bhagwan Mahavir Wildlife Sanctuary, Mollem National Park, Dr. Salim Ali Bird Sanctuary, Bondla Wildlife Sanctuary and Bhimgad Wildlife Sanctuary), requirement of maintaining the level of water in River Mandovi for navigational purposes, highly precious eco-sensitivity of the coastal estuarine system? If at all you have taken them into consideration, please show from these three Reports where, at which portion and at which page, the aforesaid factors have been reflected. Has your final

yield been determined after calculating or neglecting all these factors?

Ans. No. All the factors mentioned above are not required to be considered while finding out the yield of the basin."

967.

As far as Shri A.K. Bajaj, RW2, examined on behalf of the State of Karnataka is concerned, this Tribunal finds following statements made by the said witness in answers to question Nos.

7 and 64 put by the learned counsel for the State of Goa as well as question No. 30 put to the said witness by the Tribunal. Those questions and answers are reproduced as under:

“Q. No. 7. In answer to question number 2, you have agreed that any Trans boundary Impact is likely to be experienced by the States of Maharashtra and Goa, pursuant to the projects intended by the State of Karnataka. In view of this, please answer the following questions: -

(a) What kind of impacts would be experienced or felt by the States neighboring, more particularly, the State of Goa, which is the lower riparian State?

(b) What adverse impact will such massive eight projects proposed by the State of Karnataka have on the various projects of the State of Goa including the most essential and important drinking water projects at Ganjim and at Opa?

(c) To what extent will these projects of the State

of Goa stand affected?

(d) Will making any kind of aberration by the State of Karnataka by virtue of their proposed eight projects, which includes trans-basin diversion, severely impact the flow and the volume of the water level in river Mahadayi flowing into Goa?

(e) Would such impact not affect the environmental flow (e flow) especially in view of the fact that the river Mahadayi passes through six wildlife sanctuaries, which include Mahadayi wildlife sanctuary right on the hottest hotspot of bio-diversity of the Western Ghats and the wildlife habitat, flora and fauna, and the densely populated pristine forest species?"

"Ans. Yes, I agree that there will be some impact on the downstream States due to the projects being taken up by the upstream State. However, the question is the quantum of such impact. I have also seen the location of the project which Government of Goa is proposing from their pleadings before this Hon'ble Tribunal. The Government of Karnataka has indicated, in their pleading before this Hon'ble Tribunal, that diversion from Mahadayi, more particularly, the Bhandura, Haltara/ Kalasa, and Kotni/ Bailnadi/ Irti Projects will be during the monsoon only. The

diversion from the other projects to Kali basin are very small quantity of 0.604 tmc, 1.102 tmc and 2.613 tmc, respectively, which may or may not be taken during the monsoon only. Thus, as per the State Government of Karnataka, the withdrawal by the Government of Karnataka be only during the monsoon months, when there is plenty of water in the river, the small quantity being withdrawn will not have any major effect. The answers to the further questions are as follows:

2220

(a) Yes, there will be limited impact of reduced flow immediately downstream of the point from where the water is proposed to be withdrawn in any stream, but there will be regeneration of water in the stream from within the stream itself and the tributaries joining the stream thereof.

(b) The eight projects of Karnataka referred in the question are by no stretch of imagination massive projects. As per the standard classification of projects of the Government of India, they would be categorized as minor projects. As I have clarified, the impact is only on the immediate downstream and that also during the non-monsoon period, when flows are low. The working of the Ganjim weir seen by me is that no water is detained at the weir in the monsoon period as the gates are kept open and there will be no impact on the Ganjim weir of the withdrawal by the Government of Karnataka. As

I am not aware of the location of the Opa drinking water project, I will not be able to comment on the effect of the Karnataka projects on this project of Goa.

(c) As brought out in my Report, out of the 63 projects proposed by the State of Goa, only 8 projects, as indicated on page 17 of my Report, will be somewhat affected.

(d) As already replied, in my answer to question 7 and sub-question (a) of the present question, there will be a minor impact of the diversion by

Government of Karnataka and no severe impact can be envisaged.

(e) Many efforts have been made to define e-flows, but still there is no consensus and no values have been fixed for the same. I am not an environmental engineering expert and will not be able to say what impact there will be on the six wildlife sanctuaries in the Mahadayi basin. That can only be ascertained by carrying out an Environmental Impact Assessment study."

"Q. No. 64. In answer to the previous question, wherein you were asked about the EIA study and environmental clearance, which are a requirement mandatory in nature under a notification issued in exercise of the powers conferred by Environment Protection Act, 1986. The State Pollution Control Boards, referred to by you in your answer, based on what is mentioned in the DPR, deal with only consent to be issued under the Air Act and Water Act. The

State Pollution Control Board does not deal with either the EIA or an environmental clearance. It may have been written in the DPR prepared by some officials, perhaps technically qualified, who may or may not have all the knowledge of requirements of law. But having been a CWC Chairman at some point of time, are you so naïve, and can you be so casual while answering a question that too upon oath administered to you, so as not to know the basic and elementary distinction between the role played by the Pollution Control Boards, and the grant of environmental clearance pursuant to an EIA by the Ministry of

Environment and Forests and Climate Control or its authorised bodies?

Ans. I had not been provided any EIA study about the current projects proposed to be taken up as part of diversion scheme from Mahadayi to the nearby basin. I made a reference to the clearance from Karnataka State Pollution Control Board in my answer to the previous question, as normally it is the first step taken by the State Government in the process of obtaining further clearances in this regard. I am well aware of all the legal requirements and deny the suggestion made in the question about my being unaware about the same."

Tribunal's question no. 30:

"Q. No. 30. In reply to question No. 64, put to you by the Learned Senior Counsel of the State of Goa on 13.9.2017, you have, inter-alia, stated as under.

"I had not been provided any EIA study about the current projects proposed to be taken up as part of

diversion scheme from Mahadayi to the nearby basin. …”

In continuation to your reply to question No. 64, you also stated, “I am well aware of all the legal requirements and deny the suggestion made in the question about my being unaware about the same”. Since you are fully aware of the requirements, it is expected from you that you should have insisted for EIA studies and in the event of possible delay in completion of EIA studies, you could have made

appropriate assumptions in respect of environmental impacts and needed measures for addressing such impacts, on the basis of secondary information before undertaking the hydrological studies and water balance studies.

In this regard, please answer the following:

a. What efforts were made by you to get the requisite information with regard to EIA from secondary sources?

b. If EIA study had been supplied, would it have impacted your conclusions relating to your hydrological and water balance studies? If yes, to what extent? If no, give reasons therefor.

Ans. My answers to paras (a) and (b) are as follows:-

a. As the site specific EIA studies for the project had not been got conducted by the project engineers, which would have given the required information for making provisions in my study, I was unable to get this information from any

secondary sources. EIA studies normally are for the purpose of the project concerned and cannot be applied in general.

b. If the EIA study for the diversion project of Government of Karnataka had been carried out and indicated some quantum of minimum flows to be set aside, I would have taken this into consideration while carrying out my Study. Since

the study has not been carried out it is not possible to give any figure regarding the extent of impact .”

[Emphasis supplied]

From above, it is apparent that the State of Karnataka has not undertaken the requisite EIA study in respect of diversion of water of Mahadayi river through Kalasa-Bhandura scheme. The witnesses appearing on behalf of the State of Karnataka have also not reported any study related to impact of such diversion. However, the Tribunal finds at para 5.24, page 51 of the “Reply on behalf of the State of Karnataka (as Amended Pursuant to the Order Dated 15.04.2015 Passed by the Hon’ble Tribunal) to the Amended Sta tement of Case of Goa Dated 23.04.2015” (Volume 138), the State of Karnataka has stated as under.

“… Karnataka submits that after the construction of Kalasa dam as per Kalasa DPR 2010, about 0.15 tmc of water would be maintained as downstream flows during the non-monsoon months from December-May at the rate of 10 cusecs per day. At present there are

no flows in the river (pre-construction flows) during the months of January to May as measured by Karnataka Kalasa, inter-connecting canal for the water years 1991-92 to 1997-98. The flow tables of the Gauge reading records and yield calculations for Kalasa Nala, Haltara Nala and Surla Nala are hereto marked and annexed as Annexure R4 at pages 85 to 89.

2225

Therefore, the proposal of Karnataka to maintain 10 cusecs per day which equals to 0.15 tmc at the border during the non-monsoon months would take care of and promote ecology."

968.

The contention raised on behalf of the State of Karnataka to the effect that the proposal of Karnataka to maintain 10 cusecs per day which equals to 0.15 TMC, at the border, during the non-monsoon months would take care of and promote ecology, is not based on any scientific study and has no substance at all and cannot be accepted. This is more so in view of the Para 3.3 of the National water Policy 2012 which states as under.

"3.3 Ecological needs of the river should be determined, through scientific study, recognizing that the natural river flows are characterized by low or no flows, small floods (freshets), large floods, etc., and should accommodate developmental needs. A portion of river flows should be kept aside to meet ecological

needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use.”

In this regard it would be necessary for the Tribunal to emphasis certain other clauses of National Water Policy, 2012, which are as under:

2226

Sub-clause (iv) of clause 1.2 says:

“(iv) Climate change may also increas e the sea levels. This may lead to salinity intrusion in ground water aquifers / surface waters and increased coastal inundation in coastal regions, adversely impacting habitations, agriculture and industry in such regions.”

Whereas, Sub-clause (vii) of the said clause reads as under:

“(vii) Water resources projects, though multi - disciplinary with multiple stakeholders, are being planned and implemented in a fragmented manner without giving due consideration to optimum utilization, environment sustainability and holistic benefit to the people.”

Sub-clause 5.5 of the said Policy makes following mention:

“5.5 Inter-basin transfers are not merely for increasing production but also for meeting basic human need and achieving equity and social justice. Inter-basin

transfers of water should be considered on the basis of merits of each case after evaluating the environmental, economic and social impacts of such transfers.”

969. While explaining the concept of sustainable development, Shri Shyam Divan, the learned Senior Counsel on

behalf of the State of Karnataka has relied upon India's National Environment Policy, 2006, which reads as under:-

"Economic growth, in its turn, bears a dichotomous relationship to environmental degradation. On the one hand, growth may result in "excessive" environmental degradation through use of natural resources and generation of pollution aggravated by institutional failures. If impacts on the environmental resource base are neglected, an incorrect picture is obtained from conventional monetary estimates of national income. On the other hand, economic growth permits improvement in environmental quality by making available the necessary resources for environmental investments, and generating societal pressures for improved environmental behaviour, and institutional and policy change.

The following Principles, may accordingly, guide the activities of different actors in relation to this policy.

Each of these Principles has an established genealogy

in policy pronouncements, jurisprudence, international environmental law, or international State practice:

i. Human Beings are at the Centre of Sustainable Development concerns:

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

ii. The Right to Development:

The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

iii. Environmental Protection is an Integral part of the Development Process:

In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it”

970.

However, this Tribunal is of the opinion that the pertinent observations, made by the Krishna Water Disputes Tribunal in its Report, Volume IV, at page 729, must be borne in mind and they are:

“Even the National Water Policy of 2002 suggests priority to the maintenance of ecology recognizing the importance of the water allocation on ecology.

The examples of environmental flows requirement were indicated to be flows to maintain the physical habitat flows, to maintain suitable water quality flows, to allow passage for migratory fish, flows to maintaining soil moisture levels, flows to maintain soil/fresh water balance, flows to recharge the aquifers, flows that maintain biodiversity and ecosystem etc.”

2229

971.

It is worth emphasizing that the environmental and ecological aspects which have to be addressed by the project authorities, in the project reports have been outlined by the Ministry of Environment and Forests (renamed now as Ministry of Environment and Forests & Climate Change). The said Ministry has also issued guidelines/checklist for submitting application for clearance of projects for environmental and forests angles. The record does not indicate that before digging and constructing deep cut canal, the State of Karnataka had followed guidelines issued by the abovementioned Ministry.

972.

Further, as per then Planning Commission letter no. 16(2)99-WR dated 30.11.2000, the concerned State Government or the project authorities are required to obtain necessary clearance from the Ministry of Environment and Forests and the Ministry of Social Justice and Empowerment before investment clearance. Here also, the Tribunal finds that, no such forest clearance, has been obtained by the State of Karnataka, which

would have ensured protection to ecology, forest etc.

2230

973.

The Tribunal finds that what is important to notice is that, it is required that the project authorities would undertake a Comprehensive Environmental Impact Assessment (CEIA) study as a part of the Detailed Project Reports, to find out if there is any adverse impact on flora, fauna, wildlife, fishing, agricultural activities, aquatic eco-system, etc. in the vicinity of the project. If so, adequate mitigation measures would be suggested to minimize such impacts. The cost of mitigation measures is then covered in the overal l project cost estimates under ‘Environment, Ecology and Forests aspects’.

974.

It may also be pointed out that the Environmental Impact Assessment (EIA) Notification of 2006 is issued by the Ministry of Environment and Forests, New Delhi dated 14.09.2006 in exercise of powers conferred under sub-section (1) and clause (v) of Sub-section (2) of Section 3 of the Environment (Protection) Act, 1986, wherein the Central Government

is

empowered to direct the State Governments, that on and from the date of its publication, the required construction of new projects or activities, listed in the Schedule to the notification, shall be undertaken in any part of the India, only after the prior environmental clearance (EC) from the Central Government or as

2231

the case may be, by the State Level Environment Impact Assessment

Authority, duly constituted by the Central

Government under sub-section (3) of Section 3 of the said Act, in accordance with the procedure specified hereinafter in this notification.

975.

as under:

The relevant paragraphs of the said notification read

“4.

Categorization of Projects and activities:

(i) All projects and activities are broadly categorized in to two categories – Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources.

(ii) All projects or activities included as Category ‘A’ in the Schedule, including expansion and modernization of existing projects or activities and

change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes of this notification;

(iii) All projects or activities included as Category ‘B’ in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/ Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC) as to be constituted for in this notification. In the absence of a duly constituted SEIAA or SEAC, a category ‘B’ project shall be treated a s a Category ‘A’ project.

In the “Schedule - List of Projects or Activities requiring prior environmental clearance”, the River Valley Projects are mentioned at Sl. No.1(c) wherein the projects covering (i) > 50 MW hydroelectric power

generation; (ii) >10,000 ha of Culturable command area are categorized in category “A” and the projects covering (i) < 50 MW >25 MW hydroelectric power generation; (ii) < 10,000 ha of Culturable command area in category “B”, subject to the General Condition as stated below:

General Condition (GC)

Any project or activity specified in Category ‘B’ will be treated as Category A, if located in whole or in part within 10 km from the boundary of (i) Protected Areas notified under the Wild Life (Protection) Act, 1972, (ii)

Critically Polluted areas as notified by the Central Pollution Control Board from time to time, (iii) Notified Eco-sensitive area, (iv) inter-State boundaries and international boundaries.

5. Screening, Scoping and Appraisal Committees

The Experts Appraisal Committees (EACs) at the Central Government and SEACs at the State or the union Territory level shall screen, scope and appraise projects or activities in Category A and Category B respectively. EAC and SEACs shall meet at least once every month.

6. Application for Prior Environmental Clearance (EC)

An application seeking prior environmental clearance in all cases shall be made in the prescribed Form 1 annexed herewith and Supplementary Form 1A, if applicable, as given in Appendix II, after the identification of prospective site(s) for the project and/or activities to which the application relates, before commencing any construction activity, or

preparation of land, at the site by the applicant. The applicant shall furnish, along with the application, a copy of the pre-feasibility project report except that, in case of construction projects or activities (item 8 of the Schedule) in addition to Form 1 and the Supplementary Form 1A, a copy of the conceptual plan shall be provided, instead of the pre-feasibility report.

…

9. Validity of Environmental Clearance (EC)

The ‘Validity of Environmental Clearance’ is meant the period from which a prior environmental clearance is granted by the regulatory authority, or may be presumed by the applicant to have been granted under sub paragraph (iv) of paragraph 7 above, to the start of production operations by the project or activity, or completion of all construction operations in case of construction projects (item 8 of the Schedule), to which the applicant for prior environmental clearance refers. The prior environmental clearance granted for a project or activity shall be valid for a period of ten years in the case of River Valley Projects.”

976.

Having regard to the above stated salutary principles, the evidence on record will have to be appreciated to answer the issues mentioned above. Shri Chetan Pandit in his testimony has laid the foundation for establishing the importance of environmental flow. The testimony of Shri Paresh Porob, AW2, fairly establishes that the wild life habitats in the Madei Wildlife

Sanctuary depends upon the water from Mahadayi River because most of the other streams go dry after the monsoon and wild life habitats of Madei Wildlife Sanctuary entirely depends on Surla and Mahadayi rivers. Further, his evidence shows that environmental stability is most important for having eco-centric approach towards conservation and not anthropo-centric. What is established by the witness is the fact that the eco-centric

approach includes ecosystems flora and fauna and humans, whereas in anthropo-centric approach, humans are given priority above flora and fauna, which can have devastating effect on environment. He has further proved that for the views expressed by him in his testimony, he has relied upon the National Forest Policy of 1988 as well as National Biodiversity Action Plan, 2008 promoted by Government of India. His testimony would show that derivation of direct economic benefit should be insubordinate to the principal aim which is to maintain environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms including Humans. This witness has in terms

established that if proposed project for diversion of Madei River waters is allowed, it will be harmful to the ecology and will also adversely affect the wild life sanctuaries and would defeat the principal aim of the National Forest Policy, 1988. The witness has reasonably proved that the Government of Goa has notified various wild life sanctuaries along the stretch of Western Ghats of Goa for water security and maintaining ecological balances.

977.

As far as the testimony of AW3, Dr. Shamila Monteiro, is concerned, the Tribunal finds that her testimony also

reasonably makes out a case that diversion of water would adversely affect the mangroves as well as breeding and sustenance of several kinds of marine fishes, number of which may not be less than 290 species. Her testimony further makes out that the aquatic ecosystem is highly complex, fragile, sensitive and specialized ecosystem that needs protection and that any diversion of water outside basin of the river Mahadayi will have a major repercussion on the ecosystem, consequently destroying the ecological equilibrium of the associated ecosystems. Her testimony undoubtedly proves that impact of large scale hydrological alteration will manifest as habitat fragmentation/loss caused by altered flows leading to loss of flood plains, riparian zones and adjacent wetlands, deterioration of estuaries, deterioration of irrigated terrestrial environments and associated surface waters. Her testimony also establishes that due to diversion of water, water quality will be reduced due to insufficient dilution of point and non-point sources of pollution and that any abstraction of water and diverting it into another basin will reduce the downstream flow, thereby causing a

decrease in recharge of ground water. What is noticeable in her testimony is that perturbations will cause a change in the natural flow regime of the river and its tributaries resulting in reduced

flow of water leading to fragmentation of minor rivers, streams and other water bodies, which will have a profound effect in availability of fresh water and would affect forests dependent species.

978.

The testimony of Shri Rajendra P. Kerkar, AW4, who has deposed as an expert witness on environment, ecology and forests, establishes that the State of Karnataka has not obtained any necessary statutory permissions and clearances under Environmental Protection Act, Forest Act and Wild Life Protection Act, but has brazenly continued with the environmental degrading construction of the interconnecting channel at Kankumbi till mid-June, 2017 and that this construction has resulted in large scale destruction to the environment. His testimony would also show that no proper environmental impact assessment study was undertaken by the State of Karnataka before embarking upon the construction of such a large scale project and on account of the work already carried out, an extremely large forest cover area is destroyed on account of

felling of trees, whereas on account of excavation work and other works carried out by the State of Karnataka mangroves myristica swamp forest etc. have been adversely affected.

2238

979.

The Tribunal notices that, Shri S.T. Nadkarni, AW5, has mentioned in his testimony that global warming and climate change assessment is likely to impact the irrigation water requirement in several ways and because of increased atmospheric temperature, evapo-transpiration will increase and the losses by direct evaporation from water bodies, reservoirs, canal surface and farms will also increase. However, in answer to Question No. 8, the witness has candidly admitted that though there would be impact of global warming on the water availability in the Mahadayi Basin, the State of Goa has not estimated the same. Further, in answer to Question No. 13, the witness has admitted that the Government of Goa has not carried out any scientific studies relating to sea level increase and increased salinity ingress in coastal area of Mahadayi River with due consideration of the scientifically predicted global warming.

980.

In answer to Question No. 16, the witness has

mentioned that the government of Goa has not examined and/or undertaken scientific studies about the effect of diversion of water by States of Karnataka
and Maharashtra, on the

agriculture of Mahadayi River Basin in the State of Goa, whereas in answer to Question No. 17, the witness has stated that the State of Goa has not commissioned any scientific studies regarding the impact of diversion of water by the States of Karnataka and Maharashtra, on the ground water flow pattern.

981.

As observed earlier, Shri A.K. Gosain, RW1, while answering Question No. 307, has given a totally vague reply and it would be safe to conclude from his answer that he had not considered or taken into account the factors, such as, utilizable yield, dependency of the State of Goa on the water coming from upstream of Mahadayi region, presence of thick and dense forestation, the fact that the river passes through Mahdei Wild Life Sanctuary, Bhagwan Mahavir Wildlife Sanctuary, Mollem National Park, Dr. Salim Ali Bird Sanctuary, Bondla Wildlife Sanctuary and Bhimgad Wildlife Sanctuary, requirement of maintaining the level of water in River Mandovi for navigational purposes, highly precious eco-sensitivity of the coastal estuarine system, in any of his three Reports.

982.

However, the most important testimony to be noticed

is that of RW2, Shri A.K. Bajaj. His reply to Question No. 7

indicates that he has agreed to the fact that there will be some impact on the downstream States due to the projects being taken up by the upstream States.

983.

In answer to Question No. 7(a), the witness has admitted that there will be limited impact of reduced flow immediately downstream of the point from where the water is proposed to be withdrawn in any stream.

984.

Further, he has admitted in answer to Question No. 30 put to him by the Tribunal, that site specific EIA studies for the project were not got conducted by the project engineers and that EIA studies normally are for the purpose of the project concerned and cannot be applied in general.

985.

On overall view of the assessment of evidence led by the parties relating to Issues Nos. 5, 11, 16, 18, 19, 21, 22, 23, 30 and 32, this Tribunal is of the firm view that it has been proved by the State of Goa that after assessing and deducting from the

available waters of river Mahadayi, required for ecological sustenance of the river valley eternally and specifically giving due consideration to the scientifically predicted global warming sea

level increase, increased salinity ingress in coastal areas etc., the share of all the riparian states should be determined. The Tribunal finds that the State of Goa has established that after taking into consideration the long term, in basin needs of the three states for the purpose of domestic water supplies, irrigation, hydropower generation, navigation, pisciculture and environmental projects, equitable share of three co-basin States should be adjudicated. The Tribunal opines that the State of Goa has proved that the proposed diversion schemes of the State of Karnataka and Maharashtra will cause severe and irreparable damage and losses to the forests, wild life, other organic life and biodiversity stratosphere of the area in Mahadayi basin, particularly in the upstream areas and also to overall ecology of the Mehdai River Basin. As found earlier, it is even the case of State of Maharashtra that any sort of diversion or utilization by any of the States, including the State of Goa, in future, in Mahadayi Basin, would result in adverse impact and would disturb the ecological balance, resulting in total disaster in Mahadayi basin. This is evident if one refers to question No. 6 put

by the learned counsel for the State of Maharashtra to witness Shri Paresh Porob, AW2. Thus, the claim of the State of Goa that diversions or utilizations by the State of Karnataka and by the

State of Maharashtra, of water of river Mahadayi would result in adverse impact and would disturb the ecological balance, resulting in total disaster in Mahadayi basin, gets support and full corroboration from the State of Maharashtra. The Tribunal holds that it is further proved by the State of Goa that the proposed diversion schemes of the State of Karnataka and State of Maharashtra would severely result in destruction, exploitation, damage, diversion of habitats from the wild life sanctuary and also diversion of water into and/or outside the wild life sanctuary etc. It is further proved by the State of Goa that diversion of any kind by the State of Karnataka and the State of Maharashtra of Inter-State Water of River Mahadayi will degrade and impact the ground water flow etc. However, the Tribunal notices that, as admitted by Shri S.T. Nadkarni AW5, the Goa has not estimated as to what would be the impact of global warming on the water availability in the Mahadayi basin nor the Government of Goa has carried out any scientific studies relating to sea level increase and increased salinity ingress in coastal area of Mahadayi River with due consideration of the scientifically predicted global warming

nor any in-depth scientific evaluation on prioritization has been undertaken by the State of Goa with due consideration to social, economic and environmental aspects. Further, his study in no

uncertain terms makes it clear that the Government of Goa has not examined and conducted any scientific studies relating to impact on reduction in flow in the river Mahadayi, if any, on the process of sedimentation nor the Government of Goa has examined and/or undertaken scientific studies about the effect of diversion of water by State of Karnataka and State of Maharashtra, on the agriculture of Mahadayi River Basin in the State of Goa. Further, his evidence also indicates that the State of Goa has not commissioned any scientific studies regarding the impact of diversion of water by the State of Karnataka and the State of Maharashtra, on the ground of water flow pattern.

986.

In the absence of data relating to estimation of quantity of water, which would adversely affect ecology, environment, salinity ingress, fisheries, wild life, flora and fauna etc., the Tribunal is not in a position to come to a definite conclusion as to what extent the above said matters would be adversely affected or what would be the percentage of such adverse effects. If such data with facts and figures had been

placed by the State of Goa before the Tribunal, it would have helped the Tribunal in recording a concrete finding and in absence of such data it is difficult to conclude for the Tribunal as

to what particular percentage wild life, ecology, environment, salinity ingress, fisheries, flora and fauna would be affected.

987.

However, the Tribunal notices that the State of Karnataka and the State of Maharashtra, are seeking diversion of water, from inter-State Mahadayi river. Therefore, those States are, hereby, directed to carry out detailed study to assess impacts, of diversion of water from Mahadayi river, on wild life, flora and fauna, fishing, agriculture activities, aquatic eco-system, process of sedimentation, ground water flow patter, ecology, flow of water into the inter-State river etc., before seeking prior environmental clearance, as stipulated in Environmental Impact Assessment Notification of 2006.

988.

In the light of above discussion, Issues Nos. 5, 11, 16, 18, 19, 21, 22, 23, 30 and 32 stand accordingly answered.

2245

NAVIGATION

989.

The aspects related to navigation are included under Issue Nos. 3, 20 and 50, which are reproduced hereunder.

“3. Whether it is proved by the State of Goa that Zuari basin is inter-connected with Mahadayi basin through Cumbarjua Canal, which runs in a north-south direction and any diversion of waters from river Mahadayi would affect the navigational channel?”

“2 0. Whether the State of Goa establishes that the proposed diversion by the States of Karnataka and Maharashtra would have severe and irreparable impact and damage on the navigation in the river Mahadayi which in turn would also impact financial, tourism and economic growth of the State of Goa and the nation?”

“50. Whether the State of Karnataka proves that navigable part of Mahadayi River in Goa is limited and in any case, such navigation is only during monsoon season?”

990.

These are the issues concerned with Mahadayi Inter-State river waters, and the impact of the proposed attempts of the State of Karnataka and the State of Maharashtra of diversion

of such waters on navigation in particular. Since these issues are closely related to one another, they are being dealt with together. Before taking up further discussion on these issues, it would be appropriate to have a glance at the pleadings of the contestant States in this regard.

991.

The claimant State of Goa pleaded in the Amended Statement of Claims (Volume 131) at paras 14A, 18D(i), 18D(ii), 18F, 24A, 24B, 24C, 24D, 24E, 24F, 24G, 25, 25A, 25B, 25C, 25D, 25E, 154C, 168, 190C(ii), 191, 195, 221 and 224A as under:

“14A. The State of Goa states that at the time of submission of information/data/documents to the Agency appointed by the State of Goa for the preparation of the sedimentation/ bio diversity studies, the State of Goa undertook the process of digitization of river maps/plan relating to length of River Mhadei within the State of Goa. The State of Goa states that while conducting the said exercise, it was noticed that the length of River Mhadei within the State of Goa is 76

kms as against the originally estimated length of 52 kms. It may be noted that the length of the said River within the State of Karnataka is 35 kms. The total length of River Mhadei is therefore 111 kms. The State of Goa further states that as a result of the digitization of maps / plans, it is revealed that the length of the River upto which the salinity ingress impact is felt (i.e. upto Ganjem discharge measuring site) is 46 kms. from the mouth of

the river as against the originally estimated length of 36 kms. There is a long established navigational networking the Mhadei River in the last reach of 46 kms. The State of Goa states and submits that references to the length of River Mhadei as given at paras 18,18A,23,25, and 165 of the amended statement of case filed by State of Goa may be read in the light of the clarification stated above."

"18D(i). It is submitted that the l ong-term water requirement is estimated not only for irrigation. Water is also required for hydro-power, drinking purpose, industrial use, environmental flows, inland navigation, salinity control and maintenance of appropriate river morphology. …"

"18D(ii). As a matter of fact, State of Goa has already commissioned one more study for ascertaining the water requirement for environmental flow, salinity control, inland navigation and river morphology. The State of Goa craves leave to refer to and rely upon copy

of the said study report once the same is completed."

"18F. In light of the aforesaid submissions it can be summarised that the State of Goa's requirements for water in the Mandovi River are for the human consumption – irrigation, domestic use, industrial use; and also for conservation of flora and fauna, for maintaining the appropriate river morphology for navigation, for sediment flushing, and to prevent salinity

intrusion, both in the river and also in the aquifer. These environmental and morphological needs require maintaining an adequate flow in the river."

"24A. The State of Goa states and submits that the State of Goa has about 555 Kms. of inland water ways, out of which about 255 Kms. are navigable through rivers Mhadei and Zuari including through the Cumbharjua canal and their respective tributaries. The State of Goa further states and submits that out of their total length, the better part of these navigational channels is being used by the Mining and Export industry for transportation of iron ore to the Port of Mormugao from the loading points in the hinterlands. The State of Goa states that these internal waterways are natural waterways which provide quick and navigational transportation facilities in the State of Goa for passengers as well as cargo traffic. These channels are in existence since times immemorial. It is pertinent to note that the Shipping Industry in Goa plays a pivotal role in

the economic growth of not only the State but also the nation.… The State of Goa further submits that there are various ferry routes in the State of Goa, such as Panaji to Betim, Ribandar to Chorao, Ribandar to Divar, Old Goa to Divar, Gaundale to Kumbarjua, Sarmonas to Marcel, Amona to Mayem, Narvem to Divar, Aldona to Kalvim, Aldona to Khorjuem etc. All the aforesaid are on river Mhadei and in addition to the aforesaid Ferry boats meant for passenger and vehicle transportation there is continuous movement of barges, movement of launches, trawlers, other tourist boats, yachts being an important tourist destination, as also, huge boats

entering Panaji port, which require sufficient draft in the river, failing which the entire movement on the river on which the economy of the state is heavily dependent, as also for the commutation of general public which will be severely affected. ...”

“24B. The State of Goa states and submits that in the matter of any kind of abstraction including any kind of trans basin or inter basin diversion of Mahadayi river by the State of Karnataka and State of Maharashtra is a matter of aggravating concern for the State of Goa. The State of Goa states and submits that in the event the flow of Mahadayi River is restricted or in any manner affected by the States of Maharashtra and Karnataka, the same shall have wide spread and absolutely negative impacts in the State of Goa. Furthermore, it is pertinent to note that the present available depth within the navigational passage in the Mhadei River is 3.00 mts. over all. The movement of the vessels having the draught of 3.3 mts. is regulated to ply during the

high water period only. In the event the flow of Mahadayi river is depleted to the slightest extent, the same will result in immediate reduction of the depth of the Mhadei river in the State of Goa thereby affecting the movement of all the vessels, cargo, barges, launches as well as passengers even during the high water period. It is pertinent to note that the reduction of flow will also have a direct impact on the loading capacity of the barges, which are used by the mining industry for transportation of iron ore. The State of Goa states and submits that the revenues directly earned by the State

of Goa through the shipping and barge industry will be immediately affected, causing downturn in the revenue coffers of the State as well as loss of precious foreign exchange to the country thereby affecting the national economy. …"

"24C. The State of Goa states and submits that the reduction in flow of Mahadayi river to the slightest levels will also raise safety concerns in as much as there are maximum chances of having casualties of the barges since the Masters of the vessels will be totally misguided in the navigational approach thereby grounding or stranding of the vessels. At any rate, there will be a devastating effect across the ferry services in the inland water ways thereby causing panicky situation amongst general public an d commuters."

"24D. The State of Goa states and submits that the tourism activity in Goa has been booming since the late 1960's and the State of Goa is regarded as one of the most preferred and best tourist destinations in the

world. In furtherance of keeping up with the progress in the tourism industry, the State of Goa has continuously endeavoured to provide tourism related activities in the inner remote parts of the State, which are mostly connected through the inland water ways. The State of Goa states and submits that as a result of such promoting of tourism related activities, the tourism potential in the interior parts of the State have been booming. The immediate effect of such booming has resulted in large scale tourism related activities being

carried out on these inland water ways. The State of Goa states and submits that a large number of tourists visit such area thereby generating large amount of revenue for the State coffers as well as providing valuable employment and entrepreneurship to the local residents of the State of Goa. These inland water ways form the backbone of such tourism related activity and any reduction in the flow of the Mhadei River will have large scale impact on the tourism related activities including to the extent of wiping out this industry, which has been set up by the State of Goa through manifest efforts."

"24E. At any rate, it may be noted that the Panaji port is a seasonal port, which generally operates from mid September to mid May and the movement of barges and other water borne vessels is maintained in between Mhadei river and Zuari river through the Cumbharjua canal. The State of Goa states and submits that this is possible as there is a proper flow of run-off coming from

the Mhadei River coupled with the incursion of tidal waters from the sea, resultantly causing the depth of the water to be just about sufficient for safe navigation through the Cumbharjua canal. In the event the flow of Mhadei River is depleted to the slightest extent, the same will result in reduction of depth of the river and or canal thereby adversely affecting the movement of vessels even during the high water period."

"24F. The State of Goa further states and submits that there is already existing a massive problem of

sedimentation in Mhadei River due to the presence of silty clay, sandy silt, and beach sediments on the sea bed and the river bed, which is usually taken care by the flow of Mhadei River flushing out the sediments in addition to the dredging carried out by the State of Goa. In the event the flow of Mhadei River is depleted, the same will cause enhanced sand deposition at the mouth of Mhadei River, which would significantly affect the safe navigation during the fair weather season. The State of Goa states and submits that even regular maintenance dredging will not be suffice to ensure safe navigation and any advanced levels of maintenance dragging used will be at very high cost making the entire operation economically unviable and furthermore, also cause damage to the fragile eco- system in the River."

"24G.The State of Goa therefore submits that the inland water ways of Goa are a life line of Goa and any attempt whatsoever to reduce the flow of Mhadei river even to a minuscule extent will cause the navigational traffic in

inland water ways of Goa to be completely disrupted and such disruption will have disastrous effect on the economy of the State and Nation as well as the local residents."

"25. Mandovi is navigable in Goa territory in its last 35 Km of length. Total length of the Mandovi from the source to the sea is 87 Km. the initial 35 Km. of the river is in Karnataka and the remaining 52 Km. in Goa state. There is a long established navigation in the Mandovi River in the last reach of 35 Km. carrying passenger and

goods and specially the iron ore. There is a long established fishing occupation also in this reach of the river. Tourism and fishing, iron ore industries, and Agro Chemical industries depend on the available Mandovi waters. On the Dudhsagar/Khandepar, thereisthe existing Opa headworks which meets the domestic and the industrial water supply needs of Tiswadi (Panaji) and Ponda Talukas."

"25A. The proposed diversion by the State of Karnataka would also have severe and irreparable impact and damage on the navigation in the River Mhadei. It is pertinent to note that mining and export of mineral ore and tourism are the backbone of Goan economy and also make substantial contribution to the national GDP. The MormugaoPort serves as an outlet for export of iron ore. The iron ore stocks are brought to the MormugaoPort through barges, which ply on the Mandovi and Zuari rivers. The MormugaoPort, which is situated in Zuari basin, is connected to the Mhadei basin

(Mandovi River) through a natural channel known as ‘Cumbharjua channel’. It is submitted that the Aguada bay of Mhadei River and the Cortalim bay of Zuari River culminates into and forms Mormugao bay, where the MormugaoHarbour is situated. It is further submitted that the navigational channel through the last stretch of River Mandovi extends into the sea and ends with the Port, which is located on the banks of River Zuari. There are 30 river loading jetties along the Mandovi River. It is submitted that at present, around 600 barges transit through this channel.

“25B. It is pertinent to note that Cumbharjua Channel is a natural channel having a length of about 17 kms. and an existing draft (water depth) of approx. 2.60 mts. or more. It is submitted that smooth and safe passage of barges through the Cumbharjua Channel is possible at present since a draft (water depth) of 2.60 mts. or thereabouts is available. However, the proposed diversion of water of River Mhadei will affect the existing draft of the river/Cumbharjua channel and hamper smooth and safe nav igation in the region.”

“25C. It is an acknowledged fact that every navigational channel runs the risk of sediment deposition in its channel and the sediments entering the channel needs to be flushed out by force of flowing water. It is a further known fact that such sediments may enter the river not only from the upstream catchment but also from the sea side. Flushing of sediments requires not only a particular depth of water but also certain amount of velocity or water flow. It is submitted that even in the

present situation, there is a severe problem of sediment deposition noticed between Diwar and Chorao islands. It is submitted that any further reduction in the flow of river Mandovi due to the proposed diversion scheme of the State of Karnataka will only aggravate such sediment deposition due to reduction in velocity/water flow in the Mandovi River and Cumbharjua Channel."

25D. It is further pertinent to note that flow of water from Mandovi through the Cumbharjua channel and then to Zuari and Mormugao Port helps flushing of

sediments in the navigational reach comprising of Cumbharjua, Zuari and Mormugao Port. The contention raised by the State of Karnataka at para 4(36) of its rejoinder dated 15.07.2013 to the effect that the Cumbharjua channel is an artificial interconnection and that no water from Mandovi River flows down to Zuari River through the Cumbharjua channel is emphatically denied.

25E. The diversion of water from River Mhadei which is proposed by the State of Karnataka would reduce the existing draft (water depth) critically and thereby affect the inland navigation, movement of iron ore laden barges and other tourism related cruise liners in the Mandovi River and more particularly in the Cumbharjua Channel.

“154C. It is further submitted that the State of Karnataka is going with the Kalsa Bandura Project without assessing the likely impact of the reduction in flows caused by the construction of Haltara Dam, Kalsa

Dam, Inter-connecting canal connecting Haltara Reservoir with Kalsa Reservoir and Interconnecting canal connecting Kalsa Reservoir to Malaprabha River on the River Mhadei, on its Flora, Fauna, wildlife and other environmental factors like salinity, navigation, agriculture, industries, fisheries etc. It is submitted that the proposed diversion of 7.56 TMC of water from Mhadei to Malaprabha basin would considerably reduce the flow of water of the River Mhadei and its Tributaries/ Nalas. It is further pertinent to note that the

Bandura dam proposed site is located very close to the Bhimgad Wildlife Sanctuary and in any case it is within the buffer zone. It is submitted that any construction activity would definitely effect the flora and fauna in that Area."

"168. The Mandovi estuary is navigable round the year up to about 35 km from the mouth upstream and is one of the two main waterways of Goa mainly used for transporting iron ore barges of capacity 1,000-1,500 tons and transported to the Mormugao Port for export. The depth of estuary varies from 8-10m at the mouth to less than 2m."

"190C (ii).Reference is required to be made to the Judgment of the Hon'ble Supreme Court of California in the case of "National Audubon Society V/s. The Superior Court of Alpine Country dated 17/2/1983". This was a case concerning diversion of Mono Lake water by the State which had devastating effect on the nature as well as the Lake. In this case, Doctrine of Public Trust was

invoked.

……

(b) The Court explained the purpose of the public trust as under:-

“The objective of the public trust has evolved in tandem with the changing public perception of the values and uses of waterways. As we observed in Marks v. Whitney, [public trust easements (were) traditionally defined in terms

of navigation, commerce and fisheries. They have been held to include the right to fish, hunt, bathe, swim, to use for boating and general recreation purposes the navigable water of the State, and to use the bottom of the navigable waters for anchoring, standing or other purposes. We went on, however, to hold that the traditional triad of uses – navigation, commerce and fishing – did not limit the public interest in the trust res. In language of special importance to the present setting, we stated that the public uses to which tidelands are subject are sufficiently flexible to encompass changing public needs. In administering the trust the State is not burdened with an outmoded classification favouring one mode of utilization over another. There is a growing public recognition that one of the important public uses of the tidelands – a use accompanied within the tidelands trust – is the

preservation of those lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food and habitat for birds and marine life, and which favourably affect the scenery and climate of the area'."

"191. It is stated that trans -basin diversion of the Mandovi River and its tributaries by Karnataka would result not only in loss of valuable, limited water resources and its beneficial uses downstream in Goa State, but also a total loss of cheap and environmentally clean hydro power potential available within the State.

The water requirement for hydropower generation within the basin in Goa could thereafter be beneficially used for domestic, industrial, tourism, water supply needs and for irrigation and to sustain existing navigation and preservation of Goa harbour. The proposed outside the basin diversion of Mahadayi river waters by Karnataka would deprive Goa of all the above benefits and would be clearly detrimental to the in basin beneficial uses of Goa State and its inhabitants."

"195. It is submitted that in the present case, the question involved is not merely that for an "Interstate basin transfer within the States of Karnataka and Maharashtra…..The navigation and transportation through Mahadayi River, which is virtually the lifelines of the economy stand at serious peril. Highly eco-sensitive regions, including the Khazans, Puran Xeti, etc. shall be rendered extremely vulnerable. Any tampering with the Mahadayi River basin or Mahadayi River in the manner proposed by the States of Karnataka and

Maharashtra or even otherwise, is bound to increase the salinity caution, thereby rendering practically the whole Mahadayi River in the State of Goa unfit for drinking water purposes…"

"221. The existing uses require protection. The Mahadayi River or Mahadayi River Basin in the State of Goa is being used for the purpose of navigation and transportation. The major towns have come up over the edges on the Banks of River Mahadayi and on the Mahadayi River Basin. This entire area is the riddle for

culture and heritage. Several important Temples, Churches and other places of worships are in this region. This region has seen flourish of the traditional, agricultural and cultivator practices. The entire heritage and culture of the region is very intricately connected to the Mahadayi River or Mahadayi River Basin. The existing uses will have to be brought at a grinding halt in case there is any alteration in the profile of Mahadayi River and diversion of waters from its Basin."

"224A. It is respectfully submitted that the state of Goa, has a very high dependency on water related economy based on tourism, fishing, agriculture, forest, flora and fauna, navigation, inland water ways, transportation through barges for the purposes of mineral ore, loading and unloading from various areas in Goa at jetty points to Mormugao Harbour to Panaji Port, all of which is through the navigational channels in the Mhadei basin. Consequently any change in the water resource / abstraction / diversion of any kind whatsoever will have

disastrous impact not only on the economy, ecology but also on the entire river basin itself."

992.

AW-1, Shri Chetan Pandit, in his Affidavit-in-Chief (Volume 191) has stated that sometime in later half of 2014, the State of Goa undertook the process of digitization of river maps/plan relating to length of River Mahadayi within the State of Goa. AW1 has also stated that when the length of the River is

measured by a software using digitized maps, it has turned out that the length of river Mahadayi within the State of Goa is 76 kms as against the originally estimated length of 52 kms and the length of the said River within the State of Karnataka is 35 kms. According to the said witness, the total length is therefore 111 kms. It is further stated by him that as a result of the digitization of maps / plans, it is revealed that the length of the river up to which the salinity ingress impact is felt (i.e. the weir near the Ganjim discharge measuring site) is 46 kms. from the mouth of the river as against the originally estimated length of 36 kms and thus, there is a long established navigational networking in Mahadayi river in its last reach of 46 kms.

993.

Questions No. 1 and 15 by this Tribunal to AW-5, Shri S. T. Nadkarni and the replies of the witness are relevant for the present purpose and the said questions and answers are as hereunder:

“Q.No.1. At Para 28, page 13 of your Affidavit dated 4.11.2017 (Volume 208), you have stated as under:

“28. Hence inland waterways being a way of life and lifeline of Goa, diversion or abstraction by the State of Karnataka of any water will severely affect the navigational traffic.”

2261

In this regard, please answer the following.

a. Has any scientific study been undertaken and / or completed by the Government of Goa to examine the impact of diversion of water outside the basin and / or abstraction of water within the basin by co-basin States, including the State of Goa, for meeting the demand of water for various purposes (such as, drinking water, irrigation, power generation, industrial needs, etc.) on navigation?

b. Is there any study which indicates the impact of diversion / abstraction of water for various purposes on navigation in quantitative terms?

Ans. Before submitting the Statement of Claim and the Amended Statements of Claim, I had read each sentence and paragraphs of the said Statement of Claim and Amended Statements of Claim, respectively, and I reiterate and standby each sentence and paragraph in the said Statements. The said Statements/ Pleadings may be considered as my evidence on oath.

The State of Goa made attempts to examine the impact of diversion/ abstraction of water outside the basin by all the States on navigation. However, due to absence of data on sedimentation, as Ganjim G&D site did not measure any such data, inferences could not be drawn from the studies, especially as regards to navigation. However, there would be definitely some effect if water is diverted to outside the basin, as utilization in the basin itself will result in return flows in the river."

2262

“Q.No.15. Has the Government of Goa examined and conducted any scientific studies related to impact of reduction in flow in river Mahadayi, if any, on the process of sedimentation? If such studies have been conducted, what are the findings thereof?

Ans. The State of Goa had commissioned a Study through DHI. However, due to lack of data on sediment flow in the river, the study on sedimentation could not come to a logical conclusio n.”

994.

under.

The respective stands taken by the other States are as

995.

The State of Karnataka in the Amended Statement of Claim dated 15.04.2015 in I.A. 46 of 2015, the NEERI Report had been quoted in extenso and certain portions thereof deal with navigational activities as well. The relevant portion of the NEERI Report is as under:

“2.12 The NEERI report, *interalia,* concludedas

follows:

…

16. Due to the post project change in the flow regime of the Mahadayi/Mandovi, no significant impact on the phenomenon of sand bar formation at the mouth of the

2263

river, the associated navigational activities and the beach ecosystem of Goa is anticipated."

Relating to the requirement of maintaining the level of water in river Mahadayi for navigational purposes and other purposes as well, RW1, Prof. A. K. Gosain, was cross-examined and question No. 307 in this regard whether his final yield had been determined after calculating or neglecting all these factors narrated in detail in the question, the answer was "No. All the factors mentioned above are not required to be considered while finding out the yield of the basin."

996.

The relevant question (No.8) and answer thereto of RW2, Shri A.K. Bajaj, are as hereunder:

"Q.No.8. In your affidavit you have mentioned at paragraph 3, at page 3 thereof, that you have gone through the complaints, amended statement of Claims and submissions and other relevant documents filed before the Hon'ble Tribunal by the three States of Go a, Karnataka and Maharashtra, besides other related

technical reports and available data. In the statement of claim, filed by the State of Goa, there is a specific reference to the drinking water project of the State of Goa, namely, Opa Water Works. This project has been in existence since the pre-liberation times,

commenced somewhere in the year 1955. In answer to the interrogatories, filed by the State of Goa, to the interrogatories administered by the State of Karnataka (Vol.103), at page 13 thereof, in Annexure-5-1, there is a specific reference to the monthly and annual draws of drinking water from Opa. Yet, in your answer to the preceding question, you have stated that you are not aware as to where this project is located. Besides Opa project, there are number of other irrigation, as also other requirements of water of the State of Goa most of which are existing requirements have been mentioned in the Statement of Claims. Indeed, Opa finds reference in paragraphs 20, 25, 159, 159A, 159B. Furthe r, Goa's requirement for drinking water purposes, industrial use, maintenance of appropriate river morphology as also requirement of water for inland navigation have been mentioned. Further, in the Statement of Claim, it has been clearly mentioned that the 94 TMC under the Master Plan are projected

requirements, but in addition there are present use requirements of water all of which have been mentioned from paragraph 18C onwards.

In your Report, you have made a reference only to the 63 projects under the DPR, leaving out the very many water requirements in presenti, specifically pleaded by the State of Goa.

Can you please show from your Report any consideration, whatsoever, as regards impact or any reference to the existing water requirements of the State of Goa, specifically pleaded in the Statement of Claim, which you claim to have considered in paragraph 3 of your affidavit? If not, why were these important

requirements of the State of Goa ignored? Does not this blissful ignorance of yours show and display to prepare a convenient report, heavily loaded in favour of Karnataka, in your unabated enthusiasm?

Ans. In paragraph 10 of my Report, on page 16, I have specifically dealt with the claim of the State of Goa which, as mentioned in the question itself, is 94.4 TMC. The total demand for the existing drinking water projects is comparatively much lower. This is a standard requirement projection as, in many multiple use projects or basin, the major water consumption to the extent of 70 – 75% is for irrigation. The figures in para 10 of the Report also illustrate this as, the projected requirement is 2050 Mcum for irrigation as against only 208 Mcum for drinking water. These figures have been taken from the Government of Goa's Statement of Claim and amended Statement of Claim. Further, the so-called DPRs for the 63 projects submitted by the State of Goa indicate a total

requirements of only 38.53 TMC as against the claim of 94.4 TMC projected earlier before the detailed reports were submitted. As such, there is adequate quantity of water available to meet the other alleged requirements for fisheries, navigation, forest conservation, etc. as mentioned in the present question. Also, I have brought out that the effect of drawal of water by Government of Karnataka will not have much effect a few kilometres downstream of the point of the drawal.

2266

(PER TRIBUNAL: On a specific query put by the Tribunal as to whether the above said explanation with regard to the other requirements of the State of Goa, such as, fisheries, navigation, forest conservation, etc. and also the requirement of the State of Goa, which has been put in the Statement of Claim as requirement for drinking water purposes, industrial use, maintenance of appropriate river morphology as also requirement of water for inland navigation have been mentioned, the witness candidly admits that no mention thereof has been made of the aforesaid requirements of the State of Goa in his Report, Exh.KAR-RW2/1) ."

[Emphasis supplied]

997.

Thus, the answer given by this witness to a specific query put by the Tribunal, shown as emphasis supplied for the purpose of convenience, would go to show that these requirements of the claimant State of Goa had not been considered at all by RW2. Even otherwise, the State of Karnataka

had not chosen to adduce any positive acceptable evidence on the aspects relating to navigation.

998.

It may be relevant for the present purpose to refer to the relevant portions of the Brief Report on the visit of the Mahadayi Water Disputes Tribunal along with legal and technical

teams of three co-basin States to various related project sites, etc. in the States of Goa, Karnataka and Maharashtra during December 12-24, 2013, and the said portions of the Report are as hereunder:

“3.1

Visit to Mormugao Port Trust

A presentation was made by the Chairman, Mormugao Port Trust. He highlighted salient features of the Mormugao Port including its important role in gross domestic product (GDP) of the State of Goa. During the presentation, he also made a mention about the likely impact of reduction in the flow in the river Mahadayi on the operation of the Mormugao Port and hence on State’s economy. A copy of the presentation made before the Hon’ble Tribunal is at Annexure -I. Thereafter, the Hon’ble Tribunal and other members of the Team taken around various facilities, particularly the iron ore loading facilities.

During the presentation, the Advocate General, Govt. of

Karnataka observed that the statements of the Chairman, Mormugao Port Trust in respect of the activities undertaken or planned by the Govt. of Karnataka were beyond his briefs and that such statements should not be made. It was clarified that the objective of the visit by the Hon'ble Tribunal was to get acquainted with the salient features of the basin and important related activities etc. and that the statements made during the visit would not be taken note of and would not constitute part of the proceedings of the

Hon’ble Tribunal unless the same constituted part of the Statement of Case or Statement of Claims made by the respective States.

Based on the contents of the presentation, replies to the queries of the Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and other participants and clarifications made, following important points emerged.

a. Many of the information made available during the course of presentation did not constitute part of the Statement of Case or Statement of Claims made by the States before the Hon’ble Tribunal.

b. No specific studies have been made by Mormugao Port Trust in respect of the minimum quantity of water in river Zuari and river Mandovi that would be required to address the specific issues highlighted in the presentation made.

c. Mormugao Port Trust has not undertaken any study related to future fresh water requirements

from rivers and also through other conservation measures including rainwater harvesting etc.

d. Mormugao Port Trust has not made any comprehensive evaluation of likely impacts of water resources development in the entire basin covering all planned developmental activities by all the three co-basin States.

e. Mormugao Port Trust has neither prepared any proposal to address the specific issues highlighted during the presentation nor taken up the same with the Govt. of India.

2269

3.2

Visit to Cumberjua Canal

Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and the members of the visiting Team started from Panaji Jetty and after moving in the upstream of river Mandovi entered into Cumberjua canal and travelled to a considerable distance. A brief note provided by Govt. of Goa on Cumberjua canal highlighting important features is at Annexure – II. During the travel along the canal, the Team could observe low lying ancient reclaimed land called as Khazan land along with banks of the Cumberjua canal. Members of the visiting Team could also observe crocodile on the bank of the canal. Based on the information provided by the officials, replies to the queries of the Hon’ble Chairman, MWDT, Hon’ble Members of MWDT and other participants and clarifications made, following important points emerged.

a. Cumberjua canal is a natural canal connecting the

rivers Mandovi and Zuari in the tidal zone.

b. Cumberjua canal is used as navigation channel for barges to carry ores during high tides and traffic of empty barges during low tides.

c. The flow regime of rivers Mandovi and Zuari are impacted by the canal whenever there is increase or decreases in flow in any of the rivers."

999.

Though no separate study as such had been undertaken by the claimant State of Goa from the Report

aforesaid it is clear that the following important points had emerged.

1. Cumberjua canal is a natural canal connecting the rivers Mandovi and Zuari in the tidal zone.

2. Cumberjua canal is used as navigation channel for barges to carry ores during high tides and traffic of empty barges during low tides.

3. The flow regime of rivers Mandovi and Zuari are impacted by the canal whenever there is increase or decrease in flow in any of the rivers."

1000.

The claimant, State of Goa, pleaded several aspects in relation to these issues in elaboration at paras 18D(ii), 24B and 25C in particular. But, however, these pleas had not been further substantiated except for the important points which had emerged during the spot inspection by this Tribunal as specified supra. It is pertinent to note that question No. 15 to AW5 already had been referred to above and the answer of AW5 in this regard would go to show that no such study had been

undertaken by the claimant, State of Goa. Be that as it may, suffice to state that certain important points which emerged, which had been already referred to above, would help the claimant, State of Goa, to some extent.

2271

1001.

Section 9 of Inter-State River Water Disputes Act, 1956 deals with Powers of Tribunal. Sub-section (2) thereof specifies that:

“(2) The Tribunal may require any State Government to carry out, or permit to be carried out, such surveys and investigation as may be considered necessary for the adjudication of any water dispute pending before it.”

1002.

It would be relevant to have a glance at Section 9 (4) of the aforesaid Act as well, which says:

“(4) Subject to this Act and any rules that may be made hereunder] the Tribunal may, by order, regulate its practice and procedure.”

1003.

As already referred to supra, though AW5 admitted that no such study in this regard had been undertaken by the claimant, State of Goa, by virtue of Section 9 (2) of the Act aforesaid, the relevant portion of the spot Inspection Report and

important points recorded in the said Report can be relied upon by this Tribunal while answering these issues relating to the aspects of navigation. The evidence available on record as such on these aspects as adduced by the contestant States though unsatisfactory, the relevant portions of the aforesaid Report

would go in aid of the claimant, State of Goa. The scope and ambit of reference of Inter-State river water disputes and the adjudication thereof would be within a narrow compass and this Tribunal may have to answer these issues not in the background of broad vision but within the permissible limits as ordained by the law governing the field.

1004.

This Tribunal is not strictly guided or bound to follow the rules of evidence as contemplated by the Indian Evidence Act, in strict sense, though the principles in relation thereto in the realm have to be observed. That being the very scheme of the Act aforesaid, the underlined spirit of the scope of investigation specified in Section 9(2) of the Act, referred to above, would engulf in itself the spot inspection by this Tribunal as well.

1005.

In State of Karnataka vs State of Andhra Pradesh & Ors 2000 (9) SCC 572, the Apex Court at para 44 observed:

“The Inter -State Water Disputes Act having been framed

by Parliament under Article 262 of the Constitution, is a complete Act by itself and the nature and character of a decision made thereunder has to be understood in the light of the provisions of the very Act itself. A dispute or difference between two or more State Governments

having arisen which is a water dispute under Section 2(c) of the Act and complaint to that effect being made to the Union Government under Section 3 of the said Act, the Central Government constitutes a Water Disputes Tribunal for the adjudication of the disputes in question once it forms the opinion that the disputes cannot be settled by negotiations. The Tribunal thus constituted is required to investigate the matters referred to it and then forward to the Central Government a Report setting out the facts as found by it and giving its decision on it as provided under sub-section (2) of Section 5 of the Act."

1006.

It is needless to say that the concept of discharge of burden need not be observed in the technical sense and hence the spot inspection report and the relevant portions thereof can be considered by this Tribunal in this regard.

1007.

The contestant party States must have mutual

understanding and good faith in the user of the Inter-State river waters and should have mutual regard towards the needs of the other riparian States. An unhealthy contest by raising unsustainable pleas without any acceptable evidence whatsoever may land the contestant States nowhere except resulting in some confusion. If there is no just, fair, equi-distribution of Inter-State

River waters subject to the needs of the riparian States, all the States' interest wo uld suffer and their rights would be seriously prejudiced. The needs of the contestant States also have to be balanced with the priorities while dealing with concept of equi-distribution. The disproportionate nexus between the needs of the contestant States and the availability of waters in an Inter-State river can be said to be the principal reason for these quarrels between these States. Mother feeding the children with her milk is akin to the people feeding themselves with common river waters. The political boundaries or barriers must have only a limited role to play.

1008.

Thus this Tribunal has to weigh the needs of the contestant States cautiously while dealing with the concept of equi-distribution. All ambitious schemes of the contestant States cannot be permitted. Too much of exaggeration of these claims also may be unfair and unjust. Equally, outright rejection of all such claims may not be just. Thus, the rights of all riparian States are to be equally balanced. Impact on navigation in the context

of the flow of Inter-State river waters is an issue concerned with

the national interest in the context of international trade and commerce as well, to some extent.

In the light of the aforesaid discussion, these issues are to be considered and answered.

1009.

Though the State of Goa has not undertaken any study in relation to this aspect, it is pertinent to note that during the spot inspection of the Tribunal, certain important points which had emerged already had been referred to supra and hence the claimant State of Goa though had not adduced substantial evidence, is able to establish that:

1. Cumberjua canal is a natural canal connecting the rivers Mandovi and Zuari in the tidal zone;

2. Cumberjua canal is used as navigation channel for barges to carry ores during high tides and traffic of empty barges during low tides; and

3. The flow regime of rivers Mandovi and Zuari are impacted by the canal whenever there is increase or decrease in flow in any of the rivers.

2276

1010.

It is needless to say that by virtue of the inspection by the Tribunal inasmuch as some important points emerged which had been referred to above, this Tribunal is of the opinion that in view of the spot inspection report and the important points which ultimately emerged as referred to above, the claimant, State of Goa, has discharged its burden on issues No. 3 and 20 to the extent as reflected by the Brief Report on the visit of this Tribunal during December 12-24, 2013, specified supra.

1011.

It is needless to say that the State of Karnataka has not chosen to adduce any evidence and since on the said aspect even judicial notice cannot be taken, it is to be held that the State of Karnataka has failed to discharge its burden in relation to issue No. 50. Hence it is to be held that the claimant, State of Goa, is able to prove Issues No. 3 and 20 to the extent indicated above and the State of Karnataka has failed to prove issue No. 50 and hence this issue has to be answered in the negative.

Thus, these issues are answered accordingly.

2277

DETERMINATION OF WATER REQUIREMENTS OF THREE PARTY-STATES

STATE OF KARNATAKA

1012.

The Government of Karnataka, vide its letter No. WRD/08/KDM/2009 dated 22.06.2010 filed as complaint under Section 3 of the Inter State River Water Disputes Act, 1956, read with Inter-State Water Disputes Rules 1959, addressed to the Secretary to the Government of India, Ministry of Water Resources, has inter-alia, made following specific references related to water demands and equitable apportionment as under.

"…

(d) On an equitable apportionment of the waters of the inter-State river Mahadayi and its valley, whether, the equitable share of the riparian State of Karnataka is not less than 45 tmc annually (consumptive use of 24.15 tmc)?

(e) Whether the State of Karnataka is entitled to

execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of waters every year of the inter-State river Mahadayi to the Malaprabha river in the Krishna basin?

…

(g) Whether, the State of Karnataka would be justified in diverting waters of the inter-State river Mahadayi

2278

and its valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project? If so, what extent of diversion is just and reasonable?

(h) Whether, the State of Karnataka is entitled to execute Kotni hydropower project on the inter-State river Mahadayi for generation of electricity on a main river Mahadayi? If so, to what extent?

…"

1013.

Through the Amended Statement of Claims filed on 20.4.2015 (Volume. 129), the State of Karnataka in para 17, has sought following reliefs in respect of the water demand and equitable apportionment of waters of the inter-State river Mahadayi and its valley:

"17.1 Under the above circumstances, and having regard to the requirements of justice and equity, the State of Karnataka humbly prays before this Hon'ble Tribunal to:

(i) Hold that Karnataka's share in the waters of inter-State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilisation;

(ii) Hold that Karnataka is entitled to divert out of its own equitable share for consumptive utilisation:

(a) 7.56 tmc to provide drinking water to Hubli-Dharwad cities under the Kalasa-Bhandura nala projects;

2279

(iii)

(iv)

(v)

(vi)

(b) 5.527 tmc to Kali basin to augment the flows of Kali for hydro-power generation under Kali Hydro Electric Project (KHEP);

(c) remaining water for generation of power under Mahadayi Hydro-Electric Project (MHEP) at Kotni and

Hold that Goa has failed to establish that it is or is likely to be affected prejudicially by the diversion of waters of inter-State river Mahadayi and its valley as proposed by Karnataka.

Allocate 1.5 tmc for irrigation, drinking purposes and other purposes within the Mahadayi basin of Karnataka.

Declare that the surplus water available in Mahadayi basin at the proposed Kotni dam site is 7 tmc at 75%

dependability.

allocate 7 tmc of surplus water available in Mahadayi basin at the proposed Kotni dam site for utilisation in Malaprabha basin under the three following projects/schemes:

a. 3.00 TMC of water is to be utilized for protective irrigation in the DPAP area of Ramdurga, Soundatti and Bailhongal Talukas by Lift Schemes.

b. 2.00 TMC of water is to be utilized for drinking water and irrigation by recharge of ground water in the DPAP areas of Ramdurga, Soundatti and Bailhongal Talukas.

c. 2.00 TMC to be utilized for areas in Malaprabha Command, which are not getting adequate water as planned.

2280

(vii) Pass any other order or orders as this Hon'ble Tribunal deems fit in the interest of justice and equity."

1014.

In view of the information included in the Statement of Claims of the State of Karnataka and related documents, following Issues related to demand of waters of Mahadayi river basin by the State of Karnataka for various purposes, were finally framed for determination vide Tribunal's Order dated 17.7.2015.

"42. Whether the State of Karnataka proves that its share in the waters of inter-State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilization?

43. Whether the State of Karnataka proves that out of its total claims of 24.15 tmc of consumptive use of water: (a) it is entitled to consumptive use and / or diversion of 15.009 tmc of water to be drawn from flow of 75% dependability (i) through diversion of 7.56 tmc to provide drinking water to Hubli-Dharwad cities under

the Kalasa-Bhandura nala projects, (ii) through diversion of 5.527 tmc to Kali basin to augment the flows of Kali for hydro-power generation under Kali Hydro-Electric Project (KHEP), (iii) through utilization of 1.5 tmc for irrigation and drinking water purposes within Mahadayi basin, (iv) by accounting for the evaporation losses of 0.4 tmc from Kotni dam, and (v) by accounting for the evaporation losses of 0.022 tmc from Bhandura dam;

and (b) it is entitled to diversion of 7 tmc of water from the surplus water at 75% dependability outside the Mahadayi basin for irrigation and drinking purposes by utilizing the carry-over capacity in Malaprabha Dam, and comprising of (i) 3 tmc for protective irrigation in the DPAP area of Ramudurga, Soundatti and Bailhongal Talukas by Lift schemes, (ii) 2 tmc for drinking water and irrigation by recharge of ground water in the DPAP area of Ramudurga, Soundatti and Bailhongal Talukas , and (iii) 2 tmc for areas in Malaprabha Command which are not getting adequate water as originally planned as the yield has come down from 44 tmc to 27 tmc?

44. Whether the State of Karnataka proves that in addition to its claim of equitable share of 24.15 tmc for consumptive utilization, it is also entitled to non-consumptive use of 13.437 tmc of water for generation of power under Mahadayi Hydro-Electric Project (MHEP) at Kotni?"

1015.

The State of Karnataka has not reported any scheme or project through which the waters of Mahadayi river basin is being presently utilized in the State of Karnataka. Shri Mohan V. Katarki, learned Counsel for the State of Karnataka mentioned during the arguments on 21.2.2018 that the existing utilization of water by the State of Goa, in the basin is 9.395 tmc. It is also mentioned by Shri A. K. Bajaj, at Para 10, page 18 of his study titled “Hydrological Analysis of Diversions and Utilizations by the

Upstream States in Mahadayi Basin" filed along with his Affidavit dated 30.12.2016 (Volume 194), that the present utilization by Goa is 9.395 tmc. Neither Shri A. K. Bajaj nor any witness examined by the State of Karnataka, has stated and / or informed the Tribunal as to what is the extent of existing utilization of waters of Mahadayi river basin, by the State of Karnataka. Therefore, the existing utilization of waters of Mahadayi river basin by the State of Karnataka is considered as negligible.

1016.

In view of the above, the position in respect of existing utilization and the projected demand of the waters of Mahadayi river basin by the State of Karnataka emerges as under.

A. Existing utilization: Negligible

B. Projected demand of water available at 75% dependability

B(i) In-basin consumptive use

a. 1.5 tmc as projected consumptive use for drinking water and irrigation

b. 0.422 tmc as projected consumptive use in the form of evaporation losses from Kotni dam and Bhandura dam

B(ii) Diversion of water outside Mahadayi basin

a. 7.56 tmc of water for meeting the drinking water needs of Hubli-Dharwad and enroute villages by diversion through Kalasa-Bhandura project by augmenting the waters of Malaprabha reservoir

b. 5.527 tmc of water for hydropower generation by diversion of Mahadyi waters to Supa reservoir through (i) Katla-Palna diversion, (ii) Viranjole diversion, and (iii) Diggi diversion

Thus, the total water demand for consumptive use of water and diversion of water outside the basin, taken together, at 75% dependability is projected by the State of Karnataka as 15.009 tmc.

C. 13.437 tmc of projected demand for non-consumptive use i.e., for hydro-power generation under Mahadayi Hydro-Electric Project (MHEP) at Kotni out of available water at 75% dependability

2284

D. 7 tmc of projected demand of surplus water available in Mahadayi basin at the proposed Kotni dam site at 75% dependability

1017.

Before examining the projected demand of waters of Mahadayi river basin by the State of Karnataka for various purposes [either for (a) consumptive use within Mahadayi basin, or (b) for consumptive use outside Mahadayi basin by transfer of water outside the basin, or (c) for non-consumptive uses within the Mahadayi basin or (d) for non-consumptive uses outside the Mahadayi basin by transfer of water outside the basin] at 75% dependability or that out of surplus water over and above the water available at 75% dependability, it is necessary to take into account following important aspects / features, which are germaine, to projected demands of water.

Sustainable Development and Water

1018.

Shri Shyam Diwan, learned Senior Counsel for the State of Karnataka during the arguments on 16.2.2018

emphasized the need for sustainable development and quoted extensively from the report titled “Our Common Future” of the

2285

World Commission on Environment and Development headed by Gro Harlem Brundtland which was presented to the United Nations General Assembly on 4.8.1987. Shri Diwan, inter-alia, stated as under.

“On 4.8.1987, the World Commission on Environment and Development headed by Gro Harlem Brundtland presented its report *‘OurCommon Future’* tothe United Nations General Assembly (the “Brundtland Commission Report”). This report was premised on the concept of Sustainable Development, which was defined as:

“… development that meets the needs of th e present without compromising the ability of future generations to meet their own needs. ***Itcontains within it two key concepts:***

- ***theconcept of 'needs'*** *,in particular the essential needs of the world's poor,* ***towhich overriding priority should be given*** *;and*
- *theidea of limitations imposed by the state of technology and social organization on the*

environment's ability to meet present and future needs."

The Brundtland Commission Report emphasised the significance of development towards the satisfaction of human needs. The report, *inter-alia* ,states:

"Our Common Future, ***Chapter1: A Threatened Future***

2286

49. Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future. Far from requiring the cessation of economic growth, it recognizes that the problems of poverty and underdevelopment cannot be solved unless we have a new era of growth in which developing countries play a large role and reap large benefits.

Our Common Future, ***Chapter2: Towards Sustainable Development***

1. The Concept of Sustainable Development

The satisfaction of human needs and aspirations in the major objective of development. The essential needs of vast numbers of people in developing countries for food, clothing, shelter, jobs - are not being met, and beyond their basic needs these people have legitimate aspirations for an improved quality of life. A world in which poverty and inequity are endemic will always be prone to ecological and other crises. Sustainable

development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life.

6. Meeting essential needs depends in part on achieving full growth potential, and sustainable development clearly requires economic growth in places where such needs are not being met. Elsewhere, it can be consistent with economic growth, provided the content of growth reflects the broad principles of sustainability and non-exploitation of others. *But growth by itself is not enough. High levels of productive activity and widespread poverty can coexist, and can*

2287

endanger the environment. ***Hencesustainable development requires that societies meet human needs both by increasing productive potential and by ensuring equitable opportunities for all.***

11. Economic growth and development obviously involve changes in the physical ecosystem. Every ecosystem everywhere cannot be preserved intact. A forest may be depleted in one part of a watershed and extended elsewhere *,which is not a bad thing if the exploitation has been planned and the effects on soil erosion rates, water regimes, and genetic losses have been taken into account. In general, renewable resources like forests and fish stocks need not be depleted provided the rate of use is within the limits of regeneration and natural growth. But most renewable resources are part of a complex and interlinked ecosystem, and maximum sustainable yield must be defined after taking into account system-wide effects of exploitation."*

1019.

Thereafter, Shri Shyam Diwan, referred to the provisions of the India National Environment Policy, 2006 which are as under.

“India’s National Environment Policy, 2006, *inter-alia* , states:

Economic growth, in its turn, bears a dichotomous relationship to environmental degradation *.On the one*

hand, growth may result in "excessive" environmental degradation through use of natural resources and generation of pollution aggravated by institutional failures. If impacts on the environmental resource base are neglected, an incorrect picture is obtained from conventional monetary estimates of national income. ***On the other hand, economic growth permits improvement in environmental quality by making available the necessary resources for environmental investments, and generating societal pressures for improved environmental behaviour, and institutional and policy change*** .

…

The following Principles, may accordingly, guide the activities of different actors in relation to this policy.

Each of these Principles has an established genealogy in policy pronouncements, jurisprudence, international environmental law, or international State practice:

i. Human Beings are at the Centre of Sustainable

Development Concerns: *Humanbeings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.*

ii. The Right to Development: *Theright to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.*

iii. *EnvironmentalProtection is an Integral part of the Development Process: In order to achieve sustainable development,* ***environmental protection shall constitute an integral part of the***

2289

development process and cannot be considered in isolation from it.

The principle of sustainable development has been recognised by the Indian Courts as an integral part of environmental jurisprudence. The State of Goa has also placed reliance on the principle of sustainable development and has called it “pre -eminent and salutary principles of law” in its written submission (page 416-423, Vol- II).”

1020.

After citing various judgements of the Supreme Court namely, in cases of (i) Banwasi Seva Ashram *vs* Stateof UP (1986) 4 SCC 753, (ii) Vellore Citizens’ Welfare Forum *vs* Unionof India (1996) 4 SCC 647, (iii) M. C. Mehta (Taj Trapezium Matter) *vs* Union of India (1997) 2 SCC 353, (iv) Consumer Education and Research Society *vs* Unionof India (2000) 2 SCC 599, (v) Narmada Bachao Andolan *vs* Unionof India (2000) 10 SCC 664,(vi) Essar Oil Ltd. *Vs* HalarUtkarsh Samiti (2004) 2 SCC 392,(vii) N. D. Jayal *vs* Union of India (2004) 9 SCC 362, and (viii) Bombay Dyeing and

Mfg. Co. Ltd. (3) *vs* BombayEnvironmental Action Group (2006) 3 SCC 434, Shri Diwan canvassed as under.

(1)

The projects proposed by the State of Karnataka are all consistent with the principles of sustainable

development. As far as uses, such as drinking water are concerned, providing adequate water is an obligation of every State with respect to every citizen. The right to potable water is an aspect of Article 21 of the Constitution and the State of Karnataka is duty bound to ensure that the inhabitants of the twin city of Hubli-Dharwad, etc. receive drinking water in the decades to come. Projects to secure drinking water take several years to implement and the only manner of ensuring reliable drinking water supply to the cities of Hubli-Dharwad would be through the Kalasa and Bhandura schemes.

(2) Another important dimension of sustainable

development requires mitigation measures to be adopted so as to minimize the adverse environmental impact. This aspect will be fully addressed during the EIA process with its checks and balances including public hearings, expert environmental appraisal and appellate oversight by the National Green Tribunal (where

the

environmental clearance is challenged). The projects

proposed by Karnataka minimize diversion of forest lands and are generally outside the boundaries of any sanctuary or national park. Consequently, there will be a limited or *deminimis* impactas far as wildlife and forests are concerned.

(3)

In so far as the hydropower dimension of various proposed projects are concerned, hydropower is regarded as an environment friendly manner of generating electricity. This is because it is a renewable resources and because it does not involve burning of any fossil fuel which could lead to global warming through discharges of greenhouse gasses. Besides, the major component of the hydropower project concerning Kotni dam involves generation through run-of-the-river with the water flowing into the State of Goa. Significantly, the Kotni dam reservoir and discharges, after the proposed project is completed will ensure a discharge into the

State of Goa, during the lean season (non-monsoon months) and thereby possibly enhance the flow of the Mahadayi river.

2292

(4)

The principle of sustainable development is being strictly adhered to and the allocation sought by the State of Karnataka would advance sustainable development.

Sustainable Development of Water Resources

1021.

In this regard, the Tribunal notes that the Para 11 of Chapter 2 of the “Brundtland Commission Report”, states as under.

“… In general, renewable resources like forests and fish stocks need not be depleted provided the rate of use is within the limits of regeneration and natural growth. But most renewable resources are part of a complex and interlinked ecosystem, and maximum sustainable yield must be defined after taking into account system-wide effects of exploitation. ”

[Emphasis supplied]

1022.

The Tribunal also notes that the Section 4 of the Principles of the National Environment Policy 2006, inter-alia states as under.

2293

“…. iii. Environmental Protection is an Integral part of the Development Process:

In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.”

1023.

It is observed by the Tribunal that the above said two important aspects, which are primarily related to the sustainability of the water resources, have not been considered or duly addressed, while assessing the utilizable water out of available water as a part of the planning process, by the learned Senior Counsel while emphasising the use of scarce water resources for sustainable development of the society as a whole.

1024.

Shri Diwan, learned Senior Counsel has merely stated that the aspect related to environmental impacts will be fully addressed during the EIA process with its checks and balances including public hearings, expert environmental appraisal and

appellate oversight by the National Green Tribunal (where the environmental clearance is challenged). The Tribunal finds that, undoubtedly, such fragmented approach is a matter of concern.

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1025.

The National Water Policy 2012 at Para (vii) of the Preamble has categorically raised concern about fragmented approach. Para (vii) of the Preamble of the National Water Policy 2012 states as under.

“(vii) Water resources projects, though, multi - disciplinary with multiple stakeholders, are being planned and implemented in a fragmented manner without giving due consideration to optimum utilization, environment sustainability and holistic benefit to the people .”

1026.

Further, the National Water Policy 2012 provides for planning of water resources projects after considering social and environmental aspects also. Obviously, such issues cannot be left to be examined at the appraisal stage. Para 9.2 of the National Water Policy 2012 states as under.

9.2 Being inter-disciplinary in nature, water resources projects should be planned considering social and

environmental aspects also in addition to techno-economic considerations in consultation with project affected and beneficiary families. The integrated water resources management with emphasis on finding reasonable and generally acceptable solutions for most of the stakeholders should be followed for planning and management of water resources projects.

2295

1027.

The Tribunal notes that para 18.2 of the Chapter 18

“PROTECTION OF THE QUALITY AND SUPPLY OF FRESHWATER

RESOURCES: APPLICATION OF INTEGRATED APPROACHES TO THE

DEVELOPMENT,

MANAGEMENT

AND

USE

OF

WATER

RESOURCES” of Agenda 21 of UN Documents (available at web

site https://sustainabledevelopment.un.org/content/ documents

/agenda21.pdf)which was adopted at the Earth Summit held in

Rio de Janerio in 1992 states as under.

“18.2. Water is needed in all aspects of life. The general

objective is to make certain that adequate supplies of

water of good quality are maintained for the entire

population of this planet, while preserving the

hydrological, biological and chemical functions of

ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases. Innovative technologies, including the improvement of indigenous technologies, are needed to fully utilize limited water resources and to safeguard those resources against pollution."

The Tribunal is of the firm opinion that the phrases " while preserving the hydrological, biological and chemical functions of ecosystems" and "activities within the capacity limits of nature" in the above quoted para, are very important and should guide

2296

the Tribunal while considering the concept of sustainable development.

1028.

In the year 2000, the United Nations General Assembly adopted the “United Nations Millennium Declaration” which, in very clear terms, call to stop the unsustainable exploitation of water resources which is available at the web site http://www.un.org/millennium/declaration/areas552e.htm . The relevant para (para 23 under section IV. Protecting our common environment) are reproduced hereunder.

“IV. Protecting our common e nvironment

23. We resolve therefore to adopt in all our environmental actions a new ethic of conservation and stewardship and, as first steps, we resolve:

…

• To stop the unsustainable exploitation of water resources by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies.

…”

1029.

The Tribunal notices that despite the need for in-depth studies, essentially needed for ensuring sustainable planning in a comprehensive manner, the ground reality is far

from what is desirable. This has been very clearly brought out in the first chapter of the First United Nations World Water Development Report – Water for People Water for Life (UNWWDR1), a joint report by the twenty-three UN agencies concerned with freshwater. The Report is available at web site http://www.unwater.org.publication/water-people-water-life .

The relevant extracts are reproduced hereunder.

“Water is essential for life. We are all aware of its necessity, for drinking, for producing food, for washing – in essence for maintaining our health and dignity. Water is also required for producing many industrial products, for generating power, and for moving people and goods – all of which are important for the functioning of a modern, developed society. In addition, water is essential for ensuring the integrity and sustainability of the Earth’s ecosystems. None of these facts are in dispute. And yet, we all too often take the availability of water for granted, as if there existed an abundance of the resource. This assumption has now been challenged

and found to be untenable. …”

1030.

The prevailing situation has more emphatically been highlighted in the Second United Nations World Water Development Report – A shared Responsibility (UNWWDR2), published in the year 2006. The Report is available at web site

2298

http://www.unwater.org.publication/water-shared-responsibility

The opening paragraph of the Part 1, Global Hydrology and Water Resources of the said UNWWDR2 states as under.

“The need to develop more sustainable practices for the management and efficient use of water resources, as well as the need to protect the environmental ecosystems where these resources are located, has led to fundamental shifts in awareness and public concern over the past decade. However, despite increased awareness of the issues at stake, economic criteria and politically charged reasoning are still driving water resource development decisions at most local, regional, national and international levels. Though the long-term benefits of an integrated approach to achieving sustainable water resources development have been cited in many of the global water conferences over the past decade, considerable time and change in policy will be required to implement such an approach. At present, best available practice and scientific knowledge are

rarely adequately factored into decision-making or well represented when establishing water resource policy or implementing management practices. In the mean time, the pressures on our water resources are increasing."

1031.

The Chapter 16 – the Way Forward of the Second United Nations World Water Development Report – Water in a Changing World (UNWWDR3), published in the year 2009 and

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available at web site http://www.unwater.org.publication/water-changing-world ,concludes with following.

“The challenges are great, but the unsustainable management and inequitable access to water resources cannot continue – because the risks of inaction are even greater. We might not have all the information we would like to have before acting, but we know enough to begin to take significant actions. Some leaders are already acting, showing the way. Others are ready to act. Leaders inside and outside the water domain have critical, complementary roles. Leaders in the water domain can inform the processes outside this domain and manage water resources to achieve agreed socioeconomic and environmental objectives. But leaders in government, the private sector and civil society determine the direction that actions will take. Recognizing this, they must act now!”

Environmental Considerations in Water Resources Planning

1032.

As mentioned at Para 8, Shri Shyam Diwan, learned Senior Counsel for the State of Karnataka referred to some specific provisions of the National Environment Policy 2006. The National Environment Policy 2006 is available at the web site www.moef.gov.in/sites/default/files/introduction-nep2006e.pdf .

2300

Under Section 4, para iii, page 11 of the National Environment Policy 2006, it is stated that in order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it. It is therefore, expected that all needed studies including “Environmental Impact Assessment” (EIA) and appropriate provisions would be part of the planning and the Detailed Project Report (DPR) which would be followed by environmental appraisal by the competent agencies. The EIA and DPR would be basis for mandatory clearance related to environment.

1033.

Regarding the preparation of Environmental Impact Assessment (EIA) Report, the Ministry of Environment, Forest and Climate Change has formulated “ Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA Notification, 2006 (MARK- 37)”.

1034.

The Tribunal notes that the State of Karnataka has not mentioned about the studies related to environmental impact assessment as per the “ Standard Terms of Reference (TOR) for

2301

EIA / EMP Report for Projects / Activities Requiring Environmental Clearance under EIA Notification 2006" issued by the Ministry of Environment, Forest and Climate Change in any of the pleadings or documents filed with the Tribunal. It is, however, noted that an environmental Impact assessment of proposed Mahadayi Hydro Electric Project was conducted by the National Environmental Engineering Research Institute (NEERI), Nagpur and a report on the same was prepared in September 1997 at the request of Karnataka Power Corporation Limited. A copy of the Report of NEERI has been filed by the State of Karnataka as Annexure 8 of the Statement of Claims (Volume 12 & 13). The Report of NEERI was completed long back in September 1997 and therefore, it is not in accordance with the " Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environmental Clearance under EIA Notification 2006" issued by the Ministry of Environment, Forest and Climate Change and therefore, it is difficult to accept the same.

1035.

In its Statement of Case, the State of Goa has highlighted the issues relating to environmental protection including environmental flows. The State of Goa has also

examined Shri Rajendra P. Kerkar as a witness on the subject of environment and ecology.

1036.

Shri Kerkar, the witness of the State of Goa has made specific recommendations at Para 39, pages 38-42 of his Affidavit dated 11.11.2017 (Volume 211). These recommendations, inter-alia, include recommendation in respect of environmental flow. It is, however, noted that the recommendations of Shri Kerkar in respect of environmental flow are based on the Research Report No. 107 of International Water Management Institute (IWMI), titled ‘ An Assessment of Environmental Flow Requirements of Indian River Basin s’ by V Smakhtin and M Anputhas [MARK - GOA/35(Colly)]. From replies of Shri Kerkar to specific questions, it is evident that the Research Report No. 107 has neither been critically examined nor accepted by the Ministry of Environment, Forest and Climate Change. It is also noted by the Tribunal that the authors have indicated in the Section on ‘Conclusions and the Way Forward’ of the said Report that their study is impacted because, they had not been effectively supplied with observed

flow data of reasonable amounts and quality and that the data which were acquired and used were primarily from publicly available sources (Internet) where data are outdated and no

conclusions on the accuracy or even origin of the data could be made. It has further been indicated by the authors that if the situation with access to data in India is not changed, any further EFA will be largely speculative.

1037.

At this stage, the Tribunal notes that, it is necessary, to refer to question Nos. 3 and 4 put to Shri Rajendra P. Kerkar by the Tribunal, on 23.11.2017 and the answers of Shri Kerkar, which are reproduced hereunder.

“Q. No. 3. At Para 37, page 37 of your Affidavit dated 11.11.2017 (Vol. 211), you have mentioned about a research work done by V Smakhtin and M Anputhas, working in the International Water Management Institute (IWMI), and published as Research Report 107 ‘An Assessment of Environmental Flow Requirements of Indian River Basins’.

It appears that findings of the above mentioned Research Report 107 are the basis for your Recommendations 2, 3, and 5 on pages 39 to 41 of your

Affidavit dated 11.11.2017 (Vol. 211).

Have the findings of the Research Report 107 of IWMI been critically examined and accepted by the Ministry of Environment and Forest and Climate Change?

Ans. As per my knowledge, and information the findings of the Research Report 107 of IWMI has not been examined and accepted by the Ministry of Environment & Forest and Climate Change.

Q. No. 4. Along with your Affidavit dated 11.11.2017, you have appended Annexure-IX, being An Assessment of Environmental Flow Requirements of Indian River Basins. The said Document is already taken on record and is marked as MARK-GOA/35.

The Section on ‘Conclusions and the Way Forward’ of the Research Paper 107 of IWMI, inter-alia states as under. [Ref: Page 255 of your Affidavit dated 11.11.2017 (Vol. 212),

“The study has effectively not been supplied with observed flow data of reasonable amounts and quality. The data which have been acquired and used were primarily from publicly available sources (Internet) where data are outdated and no conclusions on the accuracy or even origin of the data could be made. If

the situation with access to data in India is not changed, any further EFA will be largely speculative. …”

How the results of such study can be considered as reliable and recommended to be adopted for application?

Ans. The result derived by using global flow data base and by using e-flow calculator helps to get reliable data as per my knowledge.”

2305

1038.

In view of the position emerging from the above, the Tribunal is of the opinion that the recommendations of Shri Rajendra P. Kerkar, Witness of the State of Goa in respect of environmental flow cannot be accepted.

1039.

In this regard, the Tribunal notes that on page 48 of "Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environmental Clearance under EIA Notification 2006" of the Ministry of Environm ent, Forest and Climate Change published in April 2015 (MARK-37), there is specific mention about environmental flow release as under.

" - Environmental flow release should be 20% of the average of the 4 lean months of 90% dependable year during the lean season and 30% of Monsoon flow during monsoon season. For remaining months, the flow shall be decided by the Committee based on the hydrology and available discharge.

- A site specific study on minimum environmental flow

should be carried out.”

The Tribunal is of the view that in the absence of any specific study and other reliable recommendation and or data, the procedure prescribed for assessment of environmental flow

2306

on page 48 of “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environmental Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015, must be adopted.

Examination of the Claims of the State of Karnataka

1040.

In view of the foregoing paras, the Tribunal considers it proper and appropriate to examine the proposed demands for using the Waters of the Mahadayi river basin by the State of Karnataka from following view-points:

a. Rationale of the needs including the quantum of water required for specific purposes;

b. Reasonability and reliability of the assessment of availability of water at the project sites;

c. Assessment of quantum of water necessarily required for environmental sustenance; and

d. Quantum of water which can be safely diverted for the projected uses and contribute to sustainable development

of the areas where the water is proposed to be used.

2307

The Tribunal is of the view that the above systematic approach is necessary to ensure that the projects sustain and continue to serve the purpose for which the projects are envisaged and planned.

1041.

This is more so in view of the details which have been brought to the notice of the Tribunal in respect of two projects, namely, Malaprabha Reservoir Project and Kali Hydro Electric Power Project, which are central to the plans of the State of Karnataka for proposed use of the waters of the Mahadayi river basin.

1042.

The State of Karnataka proposes to divert a total of 14.56 tmc (7.56 tmc at 75% dependability and 7 tmc of surplus water, over and above the availability at 75% dependability) of waters of Mahadayi river basin to Malaprabha reservoir. It is noted that the Malaprabha Reservoir Project was initially planned with assessed water availability of 47.25 tmc at 75% dependability in the year 1970. However, subsequently the

water availability at 75% dependability was found to be 26.76 tmc only. The Para 5 at page 11 of the study of Shri A. K. Bajaj, Expert Witness of the State of Karnataka filed along with his

Affidavit dated 30.12.2016 (Volume 194) are reproduced hereunder.

“5. There were no measurements at the Malaprabha Dam site during the planning stage in 1970 when, the project was being formulated. The yield at the dam site was estimated on the basis of 30 years rainfall records and gauge data of 12 years of a downstream site (Kolchi Weir). This was cross verified by using isohyetal methods and on the basis of records of hydrologically similar catchments. Ultimately, the yield at 75% dependability on the basis of rainfall records was adopted as 47.25 tmc. (See page 100 to 103, Vol. 129 filed by Govt of Karnataka on 17.04.2015)

6. However, during the performance of the project after construction, the inflows started to be recorded giving yield figures at the dam site. The yield on the basis of the measured series of the 34 years for the period from 1972-73 to 2005-06, at 75% dependability was 26.76 tmc only [See page 65, Vol. 33(b)]. Thus, the project

report which contemplated an utilisation of 44 tmc had to be modified for the revised actual water available. This report titled "Modified Detailed Project Report of Malaprabha Project" was prepared by the office of the Chief Engineer, Karnataka Neeravari Nigam Limited [A Government of Karnataka Enterprise) in the year 2009 for utilisation of 27 tmc (See Vol.33 (b)]."

2309

1043.

At this stage, the Tribunal finds it necessary to refer to the pertinent observations made by Krishna Water Disputes Tribunal in respect of the Malaprabha Project, which are quite relevant. Part of the Report of Krishna Water Dispute Tribunal has been filed as MARK-KA/26 (Colly). However, the Report is available at web site of the Union Ministry of Water Resources, River Development and Ganga Rejuvenation http://mowr.gov.in/sites/default/files/KWDTReport9718468760.pdf .Relevant extracts from the “Report of the Krishna Water Disputes Tribunal with Decisions (Volume II), 1973 are as under.

“…

The Project Report to be referred to in respect of this Project is MYPK-2 and MYPK-5.The Malaprabha Project was sanctioned in the year1963 for a gross utilisation of

37.2 T.M.C., vide Planning Commission's letter No. NR-2(54)/60 dated 5th August, 1963 (un-numbered first page of MYPK-2or MYDK-12, page 7, Ex. APK-313).The Project is modified in the year 1970 by increasing the utilisation to 44 T.M.C. as under (page15 and page 17 of MYPK-5).

…

In our opinion the demand for the additional 7 T.M.C. for this Project is worth consideration.

…”

2310

Apparently, the extent of utilization from the project was enhanced to 44 tmc in the year 1970 from the earlier figure of 37.2 tmc as per the project approved by the Planning Commission in the year 1963.

1044.

Obviously the planners of the Malaprabha Project miserably failed in making reliable assessment of the water availability at the project site. As a result, the Malaprabha project has not been able to meet the expectations of the stakeholders from the project.

1045.

Almost similar situation of incorrect assessment of availability of water prevails in case of Kali Hydro Electric Power Project. It is noted that the Kali project was initially planned with estimated average yield of 119.84 tmc. However, after the construction of the project, the average yield has been found to be 95.66 tmc only. The relevant extracts from the study of Shri A. K. Bajaj, Expert Witness of the State of Karnataka filed along with his Affidavit dated 30.12.2016 (Volume 194) are reproduced

hereunder.

2311

“8. The catchmen t area at Supa Dam site (Kali Dam) across river Kali which is a west flowing river is 408 sq. miles(1057 sq.kms) and the average yield estimated on the basis of rainfall was 119.84 tmc (3394 M.cum). The construction of the project which was started in 1971 was completed in 1987. The gross storage capacity at full reservoir level and maximum water level is 147.54 tmc (4178 M.cum) and 151.96 tmc (4303 M.cum) respectively and live storage capacity is 132.73 tmc (3758.4 M.cum). The main components of the project are the Supa Dam with a designed storage capacity of 147.54 tmc and a power house for hydel generation. Again, as in the case of the Malaprabha Dam, the water yield at the time of planning the project appears to have been over estimated and the Supa Dam has filled only twice out of 29 years (1994 and 2006) since the start of filling in 1984. The recorded average yield is only 95.66 tmc. …”

1046.

The over-estimation of the available water resources at the time of planning has, undoubtedly, resulted in creation of facilities which are not fully utilized. Obviously, such errors in the estimation of available resources was a major lapse, error, fault, mistake, criminal negligence, omission, oversight and slip on part of the engineers and other high officials of the State of Karnataka who had designed, planned and prepared DPR, while constructing Malaprabha reservoir. Construction of such a big reservoir with assessed water availability of 47.25 tmc at 75%

dependability, must have involved, use of great labour force, use of great quantity of building materials, occupation of vast / large land and investment of very very large sum of public money. All these had gone into vain / waste, when one fine morning, it was realised that the water availability was only 26.76 tmc, instead of assessed water availability of 47.25 tmc. Further, as admitted by Shri A. K. Bajaj, witness for the State of Karnataka, in para 8 of his affidavit dated 30.12.2016, as in the case of Malaprabha dam, the water yield of Supa reservoir at the time of planning the dam was over assessed / estimated. Thus the Tribunal is of the opinion that the State of Karnataka is, in the habit of overestimating its water availability and the projected water availability has no legs to stand.

1047.

In these circumstances, it becomes fundamental, basic, central and primal duty of this Tribunal to examine critically and judiciously, the rationale of the needs of the Karnataka, including the quantum of water required for specific purposes, and reasonability as well as reliability of the

assessment of availability of water at the project sites.

2313

1048.

The Tribunal considers it necessary to have proper evaluation of the projected demands for various purposes as outlined in Para 1016. The projected demand of waters of Mahadayi river basin by the State of Karnataka have accordingly been examined in the following paras.

In-basin Consumptive Needs of Water of Mahadayi river basin by the State of Karnataka

1049.

The State of Karnataka has projected a demand of 1.5 tmc for consumptive use of drinking water and irrigation in the Mahadayi river basin through Mahadayi Hydro-Electric Project (MHEP).

In the “Project Report for In -basin utilisation of Mahadayi Waters in Karnataka” - Annexure 73 to the Statement of Claims filed by the State of Karnataka on 21.10.2013 [Volume 54(d)], the total in-basin requirement for different purposes are given at Para 2.4 as under:

a. Drinking water requirement – 0.05 tmc

b. Irrigation requirement – 1.00 tmc, and

c. Industrial and other requirements – 0.45 tmc

In this regard, it is necessary to notice that the State of Goa and the State of Maharashtra have not raised any objection to the proposal for in-basin uses projected by the State of Karnataka. In fact, on the last date of hearing i.e., on 22.2.2018, Shri Atmaram N. S. Nadkarni, the learned Senior Counsel for the State of Goa, on instructions, had fairly conceded that in-basin needs of the State of Karnataka and the State of Maharashtra be granted by the Tribunal. It is also found that the total in-basin requirement projected by the State of Karnataka is only about 1.5 tmc and the water available at the project site i.e., Mahadayi Hydro-Electric Project is found to be of the order of about 10.8 tmc as per the analysis made by the Tribunal. Further, basic objective of the Mahadayi Hydro-Electric Project is to generate hydropower. The releases from the Project after hydropower generation would be available in the downstream reaches of the river which could duly take care of the environmental needs with appropriate regulation schedule. Therefore, it is not considered necessary to go into critical examination of the projected consumptive demand of 1.5 tmc by the State of Karnataka. The demand of the State of

Karnataka for 1.5 tmc for consumptive use of drinking water and irrigation in the Mahadayi river basin through Mahadayi Hydro-

2315

Electric Project (MHEP) is considered as acceptable and is hereby granted by the Tribunal.

1050.

The State of Karnataka has also mentioned about the consumptive use of about 0.422 tmc in the form of evaporation losses comprising of 0.4 tmc from Kotni dam and 0.022 tmc from Bhandura dam. Evaporation losses from reservoir are inevitable and the exact quantum of such losses would depend on many factors including the final configuration of the project, particularly the features of the reservoir to be created and the regulation schedule to be adopted. However, the quantum of consumptive usage in the form of evaporation losses from the reservoir is relatively very small and hence there is no need for in-depth examination of this aspect at this stage. The suggested consumptive use on account of evaporation losses from the reservoir as proposed by the State of Karnataka is therefore, granted by the Tribunal.

Diversion of 7.56 tmc of Water from Mahadayi River Basin to Malaprabha Reservoir

1051.

The State of Karnataka has not proposed any in-basin consumptive use other than what is mentioned in the preceding

paras. The State of Karnataka has, however, proposed diversion of 7.56 tmc of water for meeting the drinking needs of Hubli-Dharwad and enroute villages by diversion through Kalasa-Bhandura project to Malaprabha Reservoir. The Tribunal notes that the proposed projects i.e., Kalasa-Bhandura projects for diversion of 7.56 tmc of water of Malaprabha reservoir, have been major source of disputes between the State of Karnataka and the State of Goa. The Tribunal also notes that the diversion of water is proposed by constructing three reservoirs namely; Bhandura, Haltara and Kalasa and a set of diversion tunnels.

1052.

As discussed earlier, it is necessary to examine the various aspects particularly, the quantum of projected demands, reasonability and reliability of assessment, availability of water at the Project sites, assessment of quantum of water necessarily required for environmental sustenance, etc.

1053.

The State of Karnataka has filed the “Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc.

from Malaprabha reservoir” as Annexure -61 to the Statement of Claims of the State of Karnataka (Volume 16). In this regard, the State of Karnataka has also examined Shri G. M. Madegowda as a

2317

witness. The Affidavit filed by Shri G. M. Madegowda (Volume 207), the Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc. from Malaprabha reservoir, along with other available information particularly, the observations of the State of Goa either through its Statement of Case (Volume 131) or through the various questions put to Shri G. M. Madegowda, the witness of the State of Karnataka and the other relevant documents filed by the party States have been examined by the Tribunal in great detail, to ascertain the extent of the rationale behind the quantum of water projected as the demand for drinking purpose.

1054.

From the “Report on Drinking Water Demand of Hubli - Dharwad, En-route villages, etc. from Malaprabha reservoir, Nov. 2012” (Vol 16), it is clear that the requirements of water of 7.56 tmc have been assessed for future, up to the year 2044 as indicated in Table-3, page 11. In the Table-3, page 11 the requirements of water for drinking purposes have been assessed for future, up to the years 2021, 2031, 2041 and 2051.

Thereafter, the water demand for the year 2044 has been computed. Shri G. M. Madegowda, the witness of the State of Karnataka was asked to explain as to why the specific year 2044

was selected for assessment of the drinking water requirement. Shri G. M. Madegowda explained that " the year 2044 AD has been chosen for assessing the future projections, since a period of three years is taken for implementation of the Project, and therefore, from the year 2041, (30 years from 2011), the year 2044 was selected". The question No. 7, put to Shri Madegowda and the answer of the same, are reproduced hereunder.

"Q.No.7. At Para 16, page 14 of your Affidavit date d 9.11.2017 (Vol. 207), you have inter-alia stated as under:

"In conclusion, I submit that Hubli -Dharwad and en-route villages and town etc. require about 7.56 tmc of water by the end of 2044 AD. The State Government has improved the water supply infrastructure and at present the work undertaken would ensure supply of 5.20 tmcft of water on 24x7 basis if Malaprabha dam is augmented by Mahadayi water to the extent of 7.56 tmc. The diversion from Mahadayi is necessary to relieve the burden on the existing water of Malaprabha dam, which

is required for meeting the requirements of command areas, etc.”

In this regard, please answer the following:

a. Why the year 2044 AD has been chosen for assessing the future projection of water requirement and the projection not made for

commonly used period, say, up to 2050 AD or 2051 AD etc.?

b. Why augmentation of full projected requirements of water from new sources has been considered necessary and why the quantum of water already available from the existing sources has not been taken into consideration while assessing the requirement of water from new sources?

c. What precisely you mean by the above statement: “relieve the burden on the existing water of Malaprabha dam which is required for meeting the requirements of command areas, etc.”? Why do you consider water needs for drinking water supply of Hubli-Dharwad twin city, which has the highest priority, as a burden?

Ans. I wish to answer the question in three parts.

a. The year 2044 AD has been chosen for assessing the future projections, since a period of three years is taken for implementation of the Project, and

therefore, from the year 2041, (30 years from 2011), the year 2044 was selected.

b. The earlier three sources which were existing, were not providing sufficient quantity of water any more. Therefore, the water from new sources was sought to be tapped. However, whatever water is available from the existing source, i.e. Neersagar reservoir, is also being taken for the purpose of planning.

c. I feel that the drinking water supply to Hubli-Dharwad twin city cannot, in any manner, be considered as a burden."

1055.

The reason put forth by Shri Madegowda that the year 2044 was chosen to take care of 30 years of advance planning (from the year 2011) and including 3 years for the implementation of the project at the time of preparation of the report in the year 2011 is not at all convincing. It is not based on well-established principles of advanced planning or careful study undertaken by the State of Karnataka nor it is supported by any scientific literature and / or standard book approved either by Central Government or any of its agencies. It is interesting to notice that the value of 7.56 tmc of water by diversion from Mahadayi basin to Malaprabha basin for meeting the drinking water requirements of Hubli-Dharwad is mentioned in the Letter No. 11/7/2000-BM/297 dated 30.4.2002 of the Ministry of Water Resources, Government of India (Page 101-102 of Volume 11) and is also mentioned in the Letter No. WRD 4 VEBATA 2000 (P) dated 30.3.2002 of the Government of Karnataka addressed to the Secretary, Ministry of Water Resources, Government of India (Pages 86-88 of Volume 11). Obviously, in the months of March –

April of the year 2002, the need for drinking water could not have been projected to be 7.56 tmc, which is just like a flowing river.

2321

1056.

However, in reply to a subsequent question, Shri Madegowda mentioned that the assessment of 7.56 tmc was corresponding to the year 2046 and not 2044. The question No. 8 put to Shri Madegowda and the reply thereof are reproduced hereunder.

“Q.No.8. Please refer to Table 3, page 11 of the Annexure- 61, “Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir” (Vol. 16) filed by the State of Karnataka. It is noted that the domestic water demand has been estimated for the years 2011, 2021, 2031, 2041 and 2051 and then for 2044. Interestingly, subsequent Tables (e.g., Table 3.1, Table 3.1.1 and Table 3.2 whose data are used for finalization of Table 3) do not include figures for 2044.

Why the water demand figures for the year 2044 AD have been indicated in the Table 3 only; and how the figures corresponding to 2044 AD have been arrived at?

(The Tribunal's questions to Shri G.M. Madegowda, RW4, remained inconclusive when the Tribunal rose for the day at 4.00 p.m. Further questions by the Tribunal to Shri G.M. Madegowda to be resumed on 01.12.2017, and the witness stands bound over to the next date of hearing, on 01.12.2017 at 11 A.M.)

Answer to Question No. 8, which remained un-answered on 30.11.2017, the previous day:

Ans.In my answer to one of the earlier questions, I had given an explanation for choosing the year 2044 for inclusion in the Table 3 of Annex.61 (Vol.16).

I have arrived at the population projections for the year 2041 and 2051, and then I have interpolated between these two years, and arrived at the figures corresponding to the year 2044 AD. The requirement of 2044 AD gets reduced, and the 7.56 TMC corresponds to the year 2046 AD. To that extent I stand corrected."

1057.

During the cross examination of Shri G. M. Madegowda, the learned Advocate General for the State of Goa raised questions on the reliability of the "Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir" (Volume 16) on the ground that although the report was dated November 2012, the Report included number of letters which were issued in December 2012. The

questions Nos. 1 &2 put to Shri Madegowda by the learned Advocate General for the State of Goa and his replies are as under.

“Q.No.1. Please refer to paragraph 4, page 3, of your Affidavit dated 09.11.2017 (Vol. 207), wherein you have

stated that Annex.61, (Vol.16) Exh.KAR-67, was submitted to Chief Engineer, WRDO in November, 2012. In this connection, kindly refer to pages 64, 69, 71(71(a)), 73, 74, 76 (76(a)), 78 (78(a)), 79 (79(a)), 80 (80(a)). All these documents appear to be dated subsequent to the said Report, which you claim to have submitted to the Chief Engineer, WRDO, Bangalore in November, 2012. In this connection I put it to you that:

a. These documents, referred to herein above did not form part of the Report at Vol.16.

b. These documents have been prepared subsequently, tailor made to suit the Report, and inserted in the Report before it was submitted to this Hon'ble Tribunal on 02.01.2013.

In view of the above, the Report titled as "Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir", at Vol. 16, is wholly unreliable and untrustworthy, and cannot be relied upon. What do you have to say?

Ans. There appears to be an apparent mistake in Para 4, at page 3 of my Affidavit. In fact the correct month in which my Report was submitted to the Chief Engineer, WRDO, Bangalore, was December, 2012. I express my apologies for the mistake. The suggestions given in the above question do not subsist in view of my explanation.

Q.No.2. I put it to you that it is apparent from the cover page of the said Report at Vol.16, Exh.KAR-67, (Annex.61), that the Report was prepared in November, 2012 itself. In the light of this, can you please now

answer the suggestion put to you in Question No. 1 above?

Ans. The Report was prepared by my subordinate Executive Engineers in November, 2012, and I verified the same during the month of December, 2012. I had a discussion with my subordinate Engineers, and a number of corrections were made in the Office of the Chief Engineer, and finally it was submitted to the Chief Engineer, WRDO, Bangalore, in the month of December, 2012. I may add that at the time of finalisation of the Report in the Office of the Chief Engineer, (my office at that time), certain documents were appended to the Report, which were dated later than the preparation of the Report by the Executive Engineers. It appears that the Report which was finalised in the month of December, 2012, and was so submitted to the Chief Engineer, WRDO, Bangalore in December, 2012, was through an inadvertence, still titled as that of November, 2012. The aforesaid Report was, finally,

submitted by the State of Karnataka before this Hon'ble Tribunal on 02.01.2013."

1058.

As noted earlier, in his affidavit dated 9.11.2017, Shri Madegowda has stated that the State Government has improved the water supply infrastructure and at present, the work undertaken, is on 24x7 basis, if Malaprabha dam is augmented by Mahadayi water, to the extent of 7.56 tmc.

2325

1059.

The Tribunal must take judicial notice of the fact, that in India, no metropolis or city or town or village gets water on 24x7 basis, either from the State Government or from Municipal Corporation or from Municipality or from Panchayat, as the case may be. Even cities like Delhi, Mumbai, Kolkata, Chennai, Hyderabad, and Bengaluru do not have water supply on 24x7 basis. While efforts for improved management are welcome, a rational and realistic approach for improving the management of drinking water supply with focus on reducing the wastage of water through losses and avoiding malfunctioning of various facilities including pumps etc. is the need of the hour.

1060.

The Tribunal notices that the learned Advocate General of the State of Goa put the question No. 4 to Shri G. M. Madegowda, witness of the State of Karnataka regarding projection of a three time jump in the population of Hubli-Dharwad area. The question No. 4 and the reply thereof are reproduced hereunder.

“Q.No.4. At Annex.6, (MARK -KA/36), of your Affidavit, you have projected a three time jump in population of the Hubli-Dharwad area. From the said chart, Annex.6 (page 264), it is apparent that the population from 1981

till 2011 increased by about 4 lacs, whereas, as per the calculation at Annex.6, it shows the likely increase of about 18 lacs from 2011 to 2051. I, therefore, put it to you that the figures of estimated population arrived at by the State of Karnataka, Annex.6, are grossly inflated in order to claim more water. What do you have to say?

Ans. I deny the suggestion."

It is found from Table 3.1.1 at page 15 of "Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir" (Volume 16) that on the basis of census data, the rate of growth of population per decade was 23% during 1981-1991, 21% during 1991-2001 and 20% during 2001-2011. However, it is apparent from Table 3.1 on page 12 of Volume 16 that for the projection of population of Hubli-Dharwad in the year 2021, 2031, 2041, 2051 and 2061, the State of Karnataka has adopted the rate of growth of population per decade as 31%, which is not at all justified and the projection of population of Hubli-Dharwad is grossly inflated, leading to a relatively much higher demand for drinking water.

1061.

Even if for the sake of arguments, the approach for the projection of future population adopted by the State of Karnataka, is assumed to be acceptable, the Tribunal finds that

2327

the assessed demand of drinking water for Hubli-Dharwad twin city for the year 2046 is much lower than what has been projected by the State of Karnataka and indicated in Table 3, page 11 of Volume 16, as is apparent from the following.

1062.

Tribunal

The population for the year 2046 is computed by the

using

the

projected

population

of

21,37,878

corresponding to the year 2041 (as given in column 6 of Table 3.1 on page 12 of Volume 16), and applying the rate of increase in population per decade @ 31% as adopted by the State of Karnataka. The projected population of Hubli-Dharwad for the year 2046, thus, works out to be 24,69,249 [21,37,878 + {(5/10) x 0.31 x 21,37,878}]. Water requirement for the population of

24,69,249 @ 135 litres per day works out to be 33,33,48,615 litres per day, i.e., 1,21,67,22,44,475 litres per year. After adding “Unaccounted for Water” @15% as per Note (ii) under Table 2.1 on page 11 of the Manual on Water Supply and Treatment (MARK-GOA/37), the water requirements for the Hubli-Dharwad twin city for the year 2046 works out to be 1,39,92,30,81,146 litres per year. In view of Note (iii) under Table 2.1, there is no need for making separate provisions for commercial, institutional and minor industries. The water requirement of

2328

1,39,92,30,81,146 litres per year is equal to 139.92 Mcum or equal to 4.94 tmc. On the other hand, the Tribunal finds that the quantum of water required for drinking water purposes for the year 2046 for twin cities of Hubli-Dharwad has been projected as 6.63 tmc by the State of Karnataka at Table 3 on page 11 of Volume 16.

1063.

Thus, even if for the sake of arguments, it is assumed that the figures of demand projected by the State of Karnataka in respect of (a) domestic water demand of en-route villages as 0.21 tmc, (b) domestic water demand of Kundagol town as 0.7 tmc, and (c) livestock demand as 0.65 tmc, are correct, the total water demand including en-route villages etc. works out to be 6.5 tmc only, and not 7.56 tmc.

1064.

Needless to mention, if the future population is estimated on the basis of appropriate approach to be selected out of various approaches for the projection as highlighted in Para 2.2.7 on pages 41-43 of Volume 16, the future need for

water requirements for drinking purposes would be far less than even 6.5 tmc.

2329

1065.

Thus the Tribunal finds that, the estimation of water needs of 7.56 tmc is on very higher side and is not in accordance with ground realities existing in our country.

Wastage of water through losses

1066.

Regarding the wastage of water through losses, the Tribunal finds that a document t itled “India: North Karnataka Urban Sector Investment Program (Tranche 2) – Hubli- Dharwad” prepared by Karnataka Urban Infrastructure Development Finance Corporation for the Government of Karnataka, states that in the Hubli-Dharwad urban area 40% of the water supplied by the water supply network leaks into the ground. In this regard, the question No. 9 was put by the Tribunal to Shri G. M. Madegowda, witness of the State of Karnataka. The question No. 9 and the answer of the same are reproduced hereunder.

“Q.No.9. A document titled “India: North Karnataka Urban Sector Investment Program (Tranche 2) – Hubli-

Dharwad" prepared by Karnataka Urban Infrastructure Development Finance Corporation for the Government of Karnataka has been downloaded from Inter-net. The Document, inter-alia, provides a profile of the sources of water available for Hubli-Dharwad. The Para related to

the sources of water i.e., surface water and ground water also includes information related to related to losses. The Para 49 of the said Document on losses are reproduced hereunder:

“ 49. Since 1956 Hubli-Dharwad has relied on piped reservoir sources, while the rural areas have increasingly relied on boreholes. Increasing amounts of water are now being abstracted for irrigation in rural areas and many boreholes are now dry or have hard mineral waters which are bad for human health and damage some crops. In the Hubli-Dharwad urban area 40% of the water supplied by the water supply network leaks into the ground. …”

(A copy of the Document titled as India: North Karnataka Urban Sector Investment Program (Tranche2)-Hubli-Dharwad, prepared by Karnataka Urban Infrastructure Development Finance Corporation for the Government of Karnataka in October,2009,

downloaded by this Tribunal from the Internet, has been handed over to the witness and is taken on record and is marked as MARK-38.)

In this regard, please answer the following:

a. Why and how such a huge amount i.e., 40% of the water supplied by the water supply network is being allowed to be wasted through leaks into the ground?

b. With measures to avoid such wastage, the quantum of water required from new sources can

be considerably reduced. Why this aspect has not been considered while assessing the water required from new sources?

c. What measures are being taken to avoid such huge wastage of water leaking into the ground?

Ans. I wish to answer this question in 3 parts:

a. The water distribution and the pipelines had been laid very long back. The joints are leaking. The pipes are also aged and incrusted, corroded and as such they are subject to leakage. The Government of Karnataka, fully knowing of this issue, is making all efforts to reduce the water supply losses to the permissible limits, by investing huge amount. The replacement of the defective pipes completely is being envisaged. Already about 1/3 rd of the population is covered with 24/7 water supply, and as such the leakage has been reduced considerably.

b. & c. The necessary measures have been taken and

are also continued to be taken up to reduce the water losses. The above aspect has been considered, and while assessing the water requirement of the population at 135 LPCD, with 15% UFW (Unaccounted for Water). After the preventive measures are taken and completed, 25% of additional water would be available for distribution to general public. However, the same is within the stipulated limits. ”

[Emphasis supplied]

2332

1067.

While admitting the extent wastage of water through losses, Shri Madegowda has informed the Tribunal that after preventive measures are taken and completed, 25% of additional water would be available for distribution to general public.

1068.

From above, it is apparent that with rational assessment of the requirement of drinking water and after taking appropriate measures for proper management of the services, the demand of water for meeting the needs of Hubli-Dharwad twin city for drinking purposes would be drastically reduced.

Alternative Sources for Meeting the Water Needs of Hubli-Dharwad

1069.

The Tribunal notices that Shri Chetan Pandit, Expert witness of the State of Goa has mentioned at Para 106 on page 118 of his Affidavit dated 9.9.2016, filed on 12.9.2016 (Volume 192), that there are two major tributaries on the right bank of Malaprabha river, namely Joul Nala and Bennihalla Nala, and a

proposal to utilize the waters of Bennihalla Nala was prepared by Mr. Sudheer Sajjan, an engineer of the Water Resources Department of the Government of Karnataka. Shri Pandit also

appended a copy of the pap er titled “Flood Control and utilization of Water in Bennihalla Basin – A Scientific Proposal by Sudheer Sajjan” as Annexure -D of his Affidavit at pages 146-154 (Volume 192).

1070.

The Tribunal notes that the State of Karnataka has not at all considered this aspect while identifying the sources to meet the demand of water for Hubli-Dharwad. In this regard, the learned Senior Counsel of the State of Goa put question Nos. 108 and 109 to Shri A. K. Bajaj, Expert witness for the State of Karnataka. Shri Bajaj stated that it was definitely possible to divert water from both the sources, the present proposal of Government of Karnataka from Mahadayi as well as from Bennihalla after making a detailed study and a DPR for this diversion. Question Nos. 108 and 109 and the answers thereof are reproduced hereunder:

“Q.No.108. There are two major tributaries on the right bank of Malaprabha River i.e Joul Nala, and Bennehalla Nalla. The Joul Nalla has a catchment area

of 244 sq. kms, and the Bennehalla Nalla has a catchment area of around 5048 sq. kms, which is more than twice the entire Mahadayi basin catchment area.

A proposal to utilize the waters of Bennehalla Nalla

was prepared by Shri Sudheer Sajjan who is/was an engineer with the Water Resources Department of Government of Karnataka, a copy of the same is marked as Annexure D and is found at Page 146 of Vol. 192 (Additional Affidavit of Examiniation-in-Chief, Shri Chetan Pandit). While answering question QT No.1, you have admitted that you had been provided with the Report submitted by Shri Chetan Pandit, the Expert Witness for the State of Goa. This report has already been produced before this Hon'ble Tribunal initially in July 2016, and thereafter in September 2016, much before you submitted your Affidavit dated 30 th December 2016.

In this proposal Mr. Sajjan has estimated the yield of the Benehalla Nala as 10.92 TMC on 75% dependability, of which, as per the same proposal, hardly 1.5 TMC has been put to use.

In view of the aforesaid, can you please state, why in your Report while considering the availability of water

for Malaprabha Dam Reservoir, you did not consider this important aspect?

Ans. The document Annexure D at Page 146 of Vol. 192 (Additional Affidavit of Examination-in-Chief, Shri Chetan Pandit) is mentioned as a flood control scheme and as such I did not consider it for the purpose of its water availability. I am also not in a position to say whether it is technically feasible or not to divert this water to the Malaprabha Reservoir.

2335

Q.No.109. Annexure-D, mentioned in the preceding question, deals with and is titled as “Flood Control and Utilization of Water in Bennihalla basin – a Scientific Proposal.” The very first line mentions as the Bennihalla, the biggest tributary of the Malaprabha ri ver … .

It is, therefore, not a flood control document, as mentioned by you in your answer, but indeed speaks of utilization of water.

I suppose that you did not consider this important document annexed to the Affidavit of Shri Chetan Pandit which was annexed for the very purpose, served by this document wherein the study made attempts to propose a major diversion scheme for its utilization. Having not adverted to this important document which would have thrown much light on the reasons for the deficit of water, if any, in Malaprabha reservoir as well as the remedy which was available within the Malaprabha basin, your Report falls short of the

required level of a study to be presented as an Expert evidence before the Tribunal. What do you wish to say?

Ans. There is no techno-economical feasibility study for diversion of this water from Bennihalla tributary and it is for this reason that I did not include in my study the possibility of whether or not this quantity of

water or any lesser quantity therefrom can be diverted to the Malaprabha reservoir. The Malaprabha reservoir is receiving approximately 21 TMC of water less than what the reservoir capacity has been designed. It is definitely possible to divert water from both the sources, the present proposal of Government of Karnataka from Mahadayi as well as from Bennihalla after making a detailed study and a DPR for this diversion. I,therefore, deny the suggestion that my Report falls short of the required level of a study."

[Emphasis supplied]

1071.

The Tribunal notices that the Plate-1, appended to the "Draft Report on Yield Studies for Mahadayi River Basin by Central water Commission – September 2001" (Volume 33A), shows several west flowing rivers which are entirely in the territory of the State of Karnataka, i.e., rivers originate in the State of Karnataka and outfall in the Arabian Sea. These rivers inter-alia include (a) Kalinadi, (b) Bedti, (c) Aghnashini, (d)

Sharavati, (e) Chakranadi, (f) Varahai, (g) Sitanadi, (h) Gurupub and (i) Netravati. Out of these sources the State of Karnataka has examined the possibility of use of water of Kalinadi and Bedti and the same is mentioned at Para 4 on pages 2- 4 of “Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprab ha reservoir” (Volume 16). At Para 4 of the above

said report, the State of Karnataka has included a comparative study of alternative water sources which include (a) Malaprabha reservoir source at Savadatti, (b) Kali river source at Dandeli, (c) Tungabhadra river source near Muvendi, (d) Almatti dam source, and (e) Bedti nala source and the same is summarized in Table-4 on page 23 of Volume 16. The Table-4 of Volume 16 is reproduced hereunder.

Table 4: Comparison of alternative drinking water supply scheme to Hubli-Dharwad at 2051 AD

Sl. No.	Parameter	Malaprabha Reservoir Source at Savadatti	Kali river Source at Dandeli	Tugabhadra river Sources near Mevundi	Almatti Dam Source
1	Water quality	Good	Good	Good	Good
2	Quality of water	Capacity of dam is 38 TMC with a dead	Entire quantity is being utilized for power generation at 3	Being enquired	Being enquired

	available	storage of 3.3 TMC	consecutive points i.e., Nagzari, Kodasalli & Kadra		
3	Loss due to diversion of water from power generation or irrigation purpose to	Area of cultivation – 14000/TMC Total area – 12.77x140	Power generation – 50MU/TMC Loss: 2051: 12.77x50x	Area of cultivation – 14000/TMC Total area – 12.77x14000 =	Area of cultivation – 14000/TMC Total area – 12.77x14000 =

	drinking purpose	00 = 1,78,780 Ac Loss: 2051: 2350x 1,78,780/1 7 0 = Rs 42.01 Cr	106x3.00 = Rs 191.55 Cr	1,78,780 Ac Loss: 2051: 2350x 1,78,780/1 7 0 = Rs 42.01 Cr	1,78,780 Ac Loss: 2051: 2350x 1,78,780/1 7 0 = Rs 42.01 Cr	1,78 Ac L 205 235 1,78 7 0 42.(
4	Static + Friction = Total head	136.72 + 87.63 = 224.35 M	318.06 + 89.18 = 407.24 M	192.97 + 133.04 = 326.01M	232.06 + 206.28 = 438.34 M	296 71.6 367
5	Length of transmission main	50 Km	56 Km	76 Km	122 Km	45 K
6	Power requirement (KVA)	15700	35300	27000	36300	317
7	Capital Cost (Present rate)	Rs 372.00 Crores	Rs 464.00 Crores	Rs 540.00 Crores	Rs 800.00 Crores	Rs (Cro
8	Power charges (Anticipated HESCOM rate at	Rs 204.76 Crores	Rs 460.38 Crores	Rs 352.13 Crores	Rs 473.42 Crores	Rs 4 Cro

	2051)					
9	Annual M&R Cost	Rs 217.82 Crores	Rs 474.16 Crores	Rs 366.17 Crores	Rs 488.91 Crores	Rs 4 Cro
10	Water Tariff					
	Domestic	Rs 12.45	Rs 27.09	Rs 20.92	Rs 27.93	Rs 2
	Non-Domestic	Rs 24.89	Rs 54.18	Rs 41.84	Rs 55.86	Rs 4
	Commercial	Rs 49.78	Rs 108.35	Rs 83.68	Rs 111.73	Rs 9

The State of Karnataka has concluded as under.

“Hence, among all the four sources, Malaprabha dam sources has the lowest capital cost, minimum power requirement, least expenditure on operation and

maintenance and lowest water tariff. Hence, it may be concluded that Malaprabha reservoir source is the most feasible source in all respects for meeting the drinking water demand of Hubli-Dharwad and surrounding towns / villages."

1072.

This aspect was also included in the written arguments of the learned Counsel of the State of Karnataka. At Para 5.37, pages 146-151of the written arguments (Volume 220), the Learned Counsel of State of Karnataka mentioned about the scientific study in respect of alternative water resources to meet the drinking water requirement of Hubli-Dharwad etc. He has quoted from EXH. KAR 67 (Volume 16) wherein it has been concluded as under.

"Hence, among all the four sources, Malaprabha dam source has the lowest capital cost, minimum power requirement, least expenditure on operation and Maintenance lowest water tariff. Hence, it may be concluded that Malaprabha reservoir source is the most

feasible source in all respects for meeting the drinking water demand of Hubli-Dharwad and surrounding towns / villages."

However, the Tribunal notes that from critical examination of the details provided in Volume 16, it is apparent that the comparison was not based on full facts. For the purpose of

estimation of the cost etc. of proposal for supply of water from Malaprabha reservoir, the cost of works related to various structures planned for diversion of water from Mahadayi basin to Malaprabha basin are not considered at all while making the comparison, making the whole exercise futile and meaningless. Accordingly, the learned counsel was asked to clarify. The reply of the learned Counsel of the State of Karnataka at Para 16.2 on page 29 (Volume 231) is as under.

"The State of Karnataka submits that these issues of cost etc., do not constitute water dispute as the State of Goa would not suffer any injury and moreover the State of Goa itself withdrawn such averments made in para 28(iv) and 28(v) of its complaint. The State of Karnataka submits that it requires two weeks' time to file information as sought. The State of Karnataka clarifies accordingly."

The clarifications offered by the learned Counsel of the State of Karnataka are far from satisfactory.

1073.

The Tribunal notes that the State of Karnataka has made the comparison between five sources, namely (a) Malaprabha reservoir source, (b) Kali river sources, (c) Tungabhadra river source, (d) Almatti reservoir source, and (e)

Bedti Nala source. The comparison has been made to justify as to why diversion from Mahadayi river basin to Malaprabha reservoir is a better option. Apart from the gross error in the comparison, wherein the cost of creating facilities for diversion of water from Mahadayi river basin to Malaprabha river have not been taken into consideration, another important aspect that has not at all been explained properly by the State of Karnataka or by any of the witnesses produced by the State of Karnataka relates to water of Malaprabha reservoir itself being a source.

1074.

It is apparent that water of Malaprabha reservoir is presently being utilized for meeting the demand of drinking water of Hubli-Dharwad since 1983. From Table 2 on page 10 of Volume 16, it is apparent that:

a. After commissioning of Malaprabha dam Stage-I, 34 MLD or 12.41 Mcum per year or 0.44 tmc per year of water is being supplied for Hubli-Dharwad since 1983;

b. After commissioning of Malaprabha dam Stage-II in 1993, additional 34 MLD or 12.41 Mcum per year or 0.44 tmc per

year of water is being supplied for Hubli-Dharwad, making a

total of 68 MLD or 24.82 Mcum per year or 0.88 tmc since 1993;

c. After emergency improvements to Malaprabha Stage – I & II in the year 2004, the total capacity for supply of water to Hubli-Dharwad was increased from 68 MLD to 73.8 MLD, resulting in supply of 26.9 Mcum per year or 0.95 tmc per year to Hubli-Dharwad twin city from Malaprabha reservoir.

d. After commissioning of Malaprabha dam Stage-III, phase I in the year 2011, additional 80 MLD is being supplied from the Malaprabha reservoir making a total of 153.8 MLD or 56.14 Mcum per year or 1.98 tmc per year.

1075.

The aspects relating to 1.98 tmc of water of Malaprabha reservoir being released to meet the drinking water requirement of Hubli-Dharwad twin city has also been stated by Shri G. M. Madegowda, witness of the State of Karnataka in reply to question No. 3 put to him by the Tribunal. The question No. 3 and the reply thereof are reproduced hereunder.

Q.No.3. At Para 11, pages 9-10 of your Affidavit dated

9.11.2017 (Vol. 207), you have inter-alia stated as

under:

2343

“The Govt. has approved the “Karnataka Urban Water Sector Improvement Project Upscaling 24x7 continuous Water Supply to cover entire corporation of Hubli-Dharwad” at an estimated cost of Rs. 1,14,600.00 lakhs. The work under the project is in progress through Karnataka Urban Infrastructure Development and Finance Corporation which on completion would provide infrastructure for 24x7 continuous water supply of 5.20 tmc drawn from Malaprabha dam (subject to allocation by this Hon’ble Tribunal)”

In this regard, please answer the following:

a. Why the “Karnataka Urban Water Sector Improvement Project Upscaling 24x7 continuous Water Supply to cover entire corporation of Hubli-Dharwad” has been planned for 5.2 tmc?

b. How a project can be approved and work on the same started by the State Government with a rider “subject to allocation by this Hon’ble Tribunal”?

c. Why the scheme has been prepared and approved

without identifying reliable and confirmed sources of water?

Ans. I wish to answer the question in three parts:

a. It is planned to provide assured and pressurized continuous water supply to Hubli-Dharwad Corporation area to a projected population of the year 2041. The 5.2 TMC of water required for that purpose has been planned by the Consultants of Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC).

2344

b. The aforesaid decision has been taken by the State Government of Karnataka as a policy decision.

c. It is the existing source where the Municipal Corporation is already drawing 1.98 TMC per year. The future planning has been done in anticipation of this Hon'ble Tribunal allotting water to the State of Karnataka.

[Emphasis supplied]

1076.

Further, the Table 2 on page 10 of Volume 16 indicates that with completion of Malaprabha dam stage III, phase II in the year 2021, additional 68 MLD i.e., 24.82 Mcum per year or 0.88 tmc per year of water of Malaprabha would be available for meeting the need of drinking water for Hubli-Dharwad twin city.

1077.

From above, it is apparent that Malaprabha reservoir is, in fact, more than adequate / sufficient existing source of water for meeting the drinking water needs of the Hubli-

Dharwad twin city with supply of 1.98 tmc of water and that by the year 2021, the total supply of water from Malaprabha reservoir is envisaged to be about 2.86 tmc.

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1078.

It is a matter of concern that these facts have not been truthfully reflected in the pleadings of the State of Karnataka nor these facts were taken into consideration while modifying the detailed project report of Malaprabha project in the year 2009. The Tribunal notes that in the said modified DPR, the reasons as to why only 0.201 tmc, towards drinking water purposes mentioned in the Salient Features at pages 15 to 35 of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B) of the year 2009 is made, have not been explained by the State of Karnataka despite the fact that: (a) drinking water supply was the first priority as per the National Water Policy 2002 as well as the Karnataka State Water Policy 2002; and (b) 0.95 tmc of water from Malaprabha reservoir was being supplied for meeting the drinking water requirements of the twin city of Hubli-Dharwad since 2004. The only explanation offered by the State of Karnataka in para 13.13 of its Statement of Claims (Volume 10) is that further augmenting supplies from the Malaprabha Schme are impossible, as the farmers of Malaprabha

command are threatening to blow up the pipes.

The Tribunal is of the opinion that blowing of the pipes by farmers of Malaprabha command is a problem relating to law

and order, to be maintained by the State of Karnataka. Merely because the State of Karnataka is not in a position to handle law and order situation prevailing in Malaprabha command, it is not justified in laying its hands on inter-State River Mahadayi. In fact, failure to maintain law and order situation by the State of Karnataka in Malaprabha command area shows inefficiency of the State of Karnataka and on this specious plea, diversion of inter-State River Mahadayi cannot be granted by the Tribunal to meet drinking needs of the Hubli-Dharwad and en-route villages.

1079.

In this regard, the answer of Shri A. K. Bajaj, the Expert witness of the State of Karnataka to the question No. 74 put to him by the learned Senior Counsel for the State of Goa is quite relevant. Shri Bajaj stated that at the time of preparing a revised Project Report of an already ongoing project, generally, the existing usages had to be protected. The question No. 74 and reply thereof are reproduced hereunder.

“Q.No.74. In your Affidavit in Evidence as well as in the Report dated 30.12.2016 (Vol.194), page 14, para 9, you

have stated that, as per National Water Policy, the drinking water needs has the highest priority. Similarly, in answer to question No.71 as well, you have stated

that drinking water needs have the highest priority as per the National Water Policy. I draw your attention to Vol.33 (B) i.e. the Modified Detailed Project Report of Malaprabha Project, submitted by State of Karnataka on 18.03.2013, more particularly, at page 17 wherein allocation is made for water supply and industrial purpose as per the revised Project Report.

From the said Report it is evident that as per the revised Project Report, the total allocation of water for industrial and drinking water taken together is 0.216 TMC out of the total of 27 TMC.

According to you, is this allocation of only 0.216 TMC in accordance with the National Water Policy which you claim to give highest priority to the drinking water?

Ans. At the time of preparing a revised Project Report of an already ongoing project, generally, the existing usages have to be protected. It is probably on this basis that the allocation have been apportioned. Iam not in a position to say as to why or what were the conditions in

the command area due to which the Government of Karnataka has given the quantities for the purposes as mentioned in the Vol. 33(B) at page 17. Based on the information contained in the Volume 33(B) at page 17, I am not in a position to say whether the allocations are justified or not."

[Emphasis supplied]

1080.

Shri Bajaj, however, has failed to explain as to why the existing usage of water in respect of drinking water, which

2348

despite being top-most priority, in the National Water Policy as well as in the State Water Policy, is / was not protected.

Further, in reply to part (d) of the question No. 14 put to Shri Bajaj by the Tribunal, he stated as under.

“I am not aware why the DPR approved in 2009 did not make more provision for drinking water in the Report. The requirements depend on the population of the area and it is possible that the provisions made in the then DPR would have met the drinking water requirements. ”

[Emphasis supplied]

1081.

If the State of Karnataka feels and is of the opinion that there is shortage of drinking water in Hubli-Dharwad twin city and that 7.56 tmc of water is essentially required for this purpose, it is always open to the State of Karnataka to modify the detailed project report of Malaprabha project, last modified in the year 2009. There is neither any legal bar, nor is there prohibition of any kind, operating against the State of Karnataka from further modifying the modified detailed project report of

Malaprabha and making a provision that 7.56 tmc of water would be made available to the twin city and other villages.

2349

1082.

From perusal of Para 1.2 – History (Earlier Proposal) of the Section 3 of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B), it is apparent that the Malaprabha project was initially planned in the year 1961 and the same was cleared by the Planning Commission in the year 1963. Subsequently, the DPR of Malaprabha project was modified in the year 1967 and the same was approved by the Government of Karnataka in the year 1969. Thereafter, the DPR was again modified in the year 1979 and was approved by the Government of Karnataka in the year 1980. As per information available with the Tribunal, the DPR of Malaprabha project was last modified in the year 1999. It is also noted that with each modification, additional new works were included in the project either in the form of new canal system or extension of canal system or increase in the command area. Obviously, this has given rise to hopes to the people of the command area and to the farmers in particular. With the revision of the water availability on a lower side at a later date, the water for supply was bound to become

deficient for meeting the demands which were planned with higher assessment of water availability. Such a scenario is akin to giving false hopes to the people of the area.

2350

1083.

As a matter of fact, the changes in water utilization pattern i.e., allocation of more water to drinking purposes with introduction of efficient use of water, particularly for irrigation, can be done without any elaborate exercise of re-designing of the facilities for which cost will be minimal.

1084.

From the perusal of “Modified Detailed Project Report of Malaprabha Project” (Volume 33B), it is apparent that following aspects have not been considered while modifying the DPR in the year 2009.

a. Adequate provisions were not made for the drinking water needs although the same has got top most priority.

b. The ground water resources of the Malaprabha basin and Malaprabha command were not duly considered for planning purposes despite availability of ground water as is apparent from the statement of State of Karnataka at para 5.130A of “Reply on behalf of State of Karnataka (as amended pursuant to the Order dated 15.4.2015 passed by

the Hon’ble Tribunal) to the Amended Statement of Case of Goa dated 23.04 .2015” (Volume 138) that “the sugarcane cultivation in Malaprabha basin in Karnataka has increased

2351

by conjunctive utilisation of surface water drawn from the canals or river lifts and ground water".

1085.

The use of ground water for sugarcane cultivation instead of using these important resources for meeting the drinking water and other needs of the people of the area, is not at all logical. The appropriate approach is to undertake planning for conjunctive use of surface and ground water resources for the benefit of the people in larger perspective.

1086.

The Tribunal notices that in its judgement rendered in case of the State of Karnataka and Ors. Vs. State of Tamil Nadu and Ors., reported in (2018) 4 SCC 1 , the Hon'ble Supreme Court has highlighted the conjunctive use of surface and ground water resources. The Hon'ble Supreme Court has observed that the recharge of ground water is principally from rainfall as well as artificial modes, namely, application of water to irrigate crops, flooding of areas caused by overflowing of streams to their sites and seepage from unlined canals, tanks and other sources. The

relevant Para from the judgment of the Hon’ble Supreme Court is reproduced hereunder.

“ 426. While exploring the possibility of ground water as an additional source to be conjunctively used along with the surface flow of river Cauvery, the factual matrix reveals, based on empirical data, that the contributions thereto are from surface water through infiltration into the ground by way of natural recharge, stream flow, lakes and reservoirs. The recharge of ground water is principally from rainfall as well as artificial modes, namely, application of water to irrigate crops, flooding of areas caused by overflowing of streams to their sites and seepage from unlined canals, tanks and other sources. …”

The Hon’ble Supreme Court after taking into consideration the above stated principles has concluded that the available ground water can be accounted for in finally determining the apportionment of the share of the otherwise deficit Cauvery basin. The relevant portion of para 428 from the judgment of the Supreme Court is reproduced hereunder.

“… However, in the attendant facts and circumstances,

in view of the studied scrutiny of all pertinent facets of the issue by balancing all factors, we are of the unhesitant opinion that at least 10 TMC of ground water available in the Delta areas of Tamil Nadu can be accounted for in finally determining the apportionment of the share of the otherwise deficit Cauvery basin without touching the yield of 740 TMC."

The Hon'ble Supreme Court has further stated as under.

2353

“ 429. To recall, the national policies discussed above, do not, as such, debar the conjunctive use of ground water, the only caveat being periodical assessment on a scientific basis thereof and to guard against exploitation of the said resource so as not to exceed the recharging possibilities. …”

1087. The State of Karnataka is being assisted by a competent team of highly qualified Engineers, highly knowledgeable Planners, highly skillful Technicians, etc. and they must have given thought to the question as to whether the modified DPR of Malaprabha project can be further modified, to enable the State of Karnataka to provide 7.56 tmc of water for

drinking purposes to the twin city and other villages, as according to the State of Karnataka, they are water starved, even after duly considering the available water resources – surface water as well as ground water. However, no attempt has been made by anyone to modify the DPR of Malaprabha project for supplying further quantity of water to the twin city and other villages, which in turn, shows the hollowness of the claim of the State of Karnataka, that it should be permitted to divert 7.56 tmc of water from Mahadayi river. The reason for not making such an attempt is not far to seek and the reason is that, in fact, there is no

scarcity of drinking water in Hubli-Dharwad twin city and other villages. Even if the State of Karnataka is of the opinion that 7.56 tmc of water is actually not needed to meet the drinking water needs of the twin city and other villages, it is always open to it to decide that a small quantity of water, say 2.0 tmc or so should be provided exclusively for drinking water to the twin city and other villages, and the State of Karnataka can do so by modifying the modified DPR of Malaprabha project. Absence of such an exercise on the specious and lame excuse as provided by Shri Bajaj, in answer to question No. 74 put to him to the effect that at the time of preparing a revised Project Report of an already ongoing project, generally, the existing uses have to be protected, has no legs to stand and cannot be accepted by the Tribunal at all. All the DPRs are always prepared for the benefit of the public and not for the satisfaction of the Planners, Engineers, Technical Team, etc. As and when an occasion arises, the DPR can always be modified to meet the different needs of the citizens residing in the State of Karnataka. Shri Bajaj could not produce any scientific literature or any standard book, in which it is laid down that, at

the time of preparing a revised Project Report, generally, the existing uses have to be protected. Therefore, such a bald assertion made by Shri Bajaj, which has no factual foundation,

can hardly provide any justification to the State of Karnataka from modifying the modified DPR of Malaprabha project, to ensure that sufficient quantity of drinking water is made available to the twin city and en-route villages. By not doing so, the State of Karnataka has violated, fundamental rights of citizens residing in the twin city and other villages, guaranteed under Section 21 of the Constitution as right to receive drinking water is one of the important concomitants of right to life, which is protected under the said Article.

1088.

This aspect of the matter has neither been addressed by the State of Karnataka, nor by any of the witnesses examined on behalf of the State of Karnataka. Having regard to the facts of the case, the Tribunal concludes that by modifying the modified DPR of Malaprabha project, the demand for diversion of water from Mahadayi river for meeting the drinking needs of twin city and other villages, would not survive at all.

1089.

From above, it is apparent that the State of Karnataka

has not explored and examined all possible options in the right perspective.

2356

1090.

Further, it is apparent that the “Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc., from Malaprabha reservoir” (Volume 16) has several inconsistencies.

1091.

From the examination of the detailed project report (DPRs) and revised DPRs of Kalasa Nalla and Bhandura Nalla projects (Volume 17&18, Volume 19, Volume 20 and Volume 21) filed by the State of Karnataka, it is found by the Tribunal that, none of the DPRs have been prepared in accordance with the “Guidelines for Preparation of Detailed Project Report of Irrigation and Multipurpose Projects” (MARK -5). Specific aspects required to be included in the detailed project reports (DPRs) and to be checked are clearly specified in Section I – Check List at pages 1 to 17 of the “Guidelines for Preparation of Detailed Project Report of the Irrigation and Multipurpose Projects” (MARK-5) under major heads namely, (i) General Data, (ii) Planning, (iii) Interstate and International Aspects, (iv) Surveys, (v) Geological Investigations, (vi) Seismic Investigations, (vii)

Foundation Investigations, (viii) Construction Material Surveys,

(ix)

Hydrological

and

Meteorological

Investigations,

(x)

Hydrology, (xi) Land Acquisition and Resettlement of Oustees,

(xii) Designs, (xiii) Irrigation and Command Area Development,

(xiv) Flood Control and Drainage, (xv) Navigation, (xvi) Power, (xvii) Construction Programme and Plant and Manpower Planning, (xviii) Foreign Exchange, (xix) Financial Resources, (xx) Estimate, (xxi) Revenue, (xxii) B. C. Ratio, (xxiii) Ecological Aspects, (xxiv) Colonies and Buildings, (xxv) Public Participation and Cooperation, and (xxvi) Soil Conservation.

1092.

The DPRs filed by the State of Karnataka are mostly devoted to preparation of estimates of the projects. The aspects of planning, particularly the ecological aspects have not been addressed in proper perspective. This is more so as the scheme involves inter-State issues and the diversion of water from one river basin to another and the schemes are required to be implemented in forest areas.

1093.

The Tribunal is of the firm view that the reports filed by the State of Karnataka as the DPRs or the revised DPRs cannot be termed as the detailed project reports in true sense and on this count alone, the proposal of the State of Karnataka deserves

to be rejected.

1094.

Though the DPR of 2000 (Volume 18) and DPR of 2010

(Volume 19) of Kalasa Nala Diversion Scheme and DPR of 2000

(Volume 20) and DPR of 2012 (Volume 21) of Bhandura Nala Diversion Scheme do not provide requisite details and cannot be termed as detailed project report in true sense, a comparison of the information included in reports indicates visible change in respect of purpose of the projects.

DPR of 2000 and DPR of 2010 of Kalasa Nala Diversion Scheme

1095.

Second and third paras from the General Report at page 2 of the " Detailed Project Report (Kalasa DPR-2000) of Kalasa Nala Diversion Scheme prepared in 2000" (Volume 18) filed by the State of Karnataka are reproduced hereunder.

"It is observed since 1972 that the reservoir is not getting contemplated 75% dependable yield on account of dwindling of rainfall and lifting of water by villagers on upstream side of catchment area .

With a result it has not been possible to supply water fully to the notified area for Kharif and Rabi etc. ,This has given an impetus to augment the Malaprabha Reservoir by diverting West flowing Kalasa and Haltara

nalas in Khanapur taluk. It is proposed to divert 3.56 TMC of water from the above nallas to the Malaprabha river."

[Emphasis supplied]

2359

From above, it is apparent that the purpose of the project is to augment the Malaprabha reservoir with the objective to supply water fully to the notified areas of Kharif and Rabi etc. It is apparently, in this background that the purpose of the project in the salient features at page 7 of Volume 18 is indicated as " To augment the storage of Malaprabha Reservoir", without any mention at all that the water so diverted would be used for drinking purposes.

1096.

Relevant extract from the General Report at page 1 of the "D etailed Project Report (Kalasa DPR-2010) of Kalasa Nala Diversion Scheme prepared in 2010" (Volume 19) filed by the State of Karnataka are reproduced hereunder.

"It is observed since 1972 that the reservoir is not getting contemplated 75% dependable yield on account of dwindling of rainfall and lifting of water by villagers on upstream side of catchment area. With a result it has not been possible to supply water fully to the notified area for Kharif and Rabi etc. ,This has given an impetus

to augment the Malaprabha reservoir by diverting west flowing Kalasa and Haltara nalas in Khanapur Taluk. It is proposed to divert 3.56 TMC of water from the above nalas to the Malaprabha river.

[Emphasis supplied]

2360

From above, it is apparent that the purpose is to augment waters of Malaprabha reservoir to supply water fully to the notified area for Kahrif and Rabi etc. In the General Report at pages 1 to 10, there is no mention about the use of diverted water for drinking purposes. However, the purpose indicated in the Salient Features at page 12 of Volume 19 is indicated as " To augment the storage of Malaprabha reservoir to meet the drinking water requirements of Hubli-Dharwad city, other towns and villages of Malaprabha basin". The purpose of the project indicated in the "Salient Features" is different from what emerges from the "General Report".

DPR of 2000 and DPR of 2012 of Bahndura Nala Diversion Scheme

1097.

DPR of 2000 and DPR of 2012 of the Bhandura Nala Diversion Scheme also present similar varying statements. Relevant extract from the General Report at page 4 of the "Detailed Project Report (Bhandura DPR -2000) of Bhandura Nala Diversion Scheme prepared in 2000" (Volume 20) filed by the State of Karnataka is reproduced hereunder.

2361

“As observed, the Malaprabha reservoir is not getting contemplated yield on account of dwindling rainfall and lifting of water by villagers on upstream side of dam with a result it has not been possible to supply water fully to notified area. Hence, it has be-come necessary to augment Malaprabha reservoir by diverting west flowing nalas to Malaprabha. Hence, the implementation of the project is essential to overcome the deficit of water in Malaprabha Dam”.

[Emphasis supplied]

It is apparent that the purpose of the project is to augment the Malaprabha reservoir with the objective to supply water fully to the notified areas of Kharif and Rabi etc. It is apparently, in this background that the purpose of the project in the salient features at page 6 of Volume 20 is indicated as “ To augment the storage of Malaprabha reservoir”, without any mention at all that the water so diverted would be used for drinking purposes.

1098.

Relevant extract from the General Report at page 1 of

the “Detailed Project Report (Bhandura DPR-2012) of Bhandura Nala Diversion Scheme prepared in 2012” (Volume 21) filed by the State of Karnataka is reproduced hereunder.

“In view of the reduction in the flow of Malaprabha River at the dam site, the meeting of drinking water needs of Hubli & Dharwad city and surrounding villages has become a difficult task. The drinking water supply to twin cities has been met once in 10 days. Hence Karnataka planned to divert a small quantity of 7.56 TMC of its Mahadayi basin contribution to Malaprabha reservoir, so as to meet the drinking water requirements of Hubli & Dharwad city, other towns and villages of Malaptabha Basin by planning Kalasa Nala and Bhandur Nala Diversion Schemes.”

The Tribunal notes a sudden change in the purpose of the pr ojects in the year 2012. As per “Detailed Project Report (Bhandura DPR-2000) of Bhandura Nala Diversion Scheme prepared in 2000” (Volume 20), the purpose of the project was to augment the Malaprabha reservoir with the objective to supply water fully to the notified areas of Kharif and Rabi etc. However, as per “Detailed Project Report (Bhandura DPR -2012) of Bhandura Nala Diversion Scheme prepared in 2012” (Volume 21),

the purpose is to augment the storage of Malaprabha reservoir to meet the drinking water requirements of Hubli-Dharwad city, other towns and villages of Malaprabha basin. In the General Report of the DPR of Bhandura Nala of 2012 (Volume21), it is also mentioned that Karnataka planned to divert a small quantity of 7.56 TMC of its Mahadayi basin contribution to Malaprabha

2363

reservoir, so as to meet the drinking water requirements of Hubli & Dharwad city, other towns and villages of Malaprabha Basin by planning Kalasa Nala and Bhandura Nala Diversion Schemes. However, the Tribunal notes that from the General Report of the DPR of 2010 of the Kalasa Nala (Volume 19), it is apparent that the purpose is to augment waters of Malaprabha reservoir to supply water fully to the notified area for Kharif and Rabi etc. The Tribunal notices that in the General Report at pages 1 to 10 of the DPR of 2010 of Kalasa Nala (Volume 19), there is no mention at all, about the diversion of 7.56 tmc of water for drinking purposes.

1099.

From the above, it is apparent that the purpose of the two projects continued to be to augment the water of Malaprabha reservoir to supply water fully to the notified area for Kahrif and Rabi etc. i.e., the purpose was simply to provide water for irrigation.

1100.

The fact that the purpose of the two schemes namely

Kalasa Nala Diversion Scheme and Bhandura Nala Diversion Scheme is to augment waters of Malaprabha reservoir for irrigation, is also evident from the “Recommendations of the

Forest Advisory Committee (FAC) in its meeting held on 28-8-2003". The State of Karnataka has made availab le a copy of the letter No. 16-90/2017-FC dated 25 th October 2017 of the Ministry of Environment, Forests and Climate Change as Enclosure-A2 (Colly) at pages 179 to 181 of the "Written Submissions on behalf of State of Karnataka" (Volume 220). Relevant extract from "Recommendations of the Forest Advisory Committee (FAC) in its meeting held on 28-8- 2003" is reproduced hereunder.

"The proposal was discussed by the Forest Advisory Committee (FAC) in detail. Managing Director of the User Agency has also presented the case before FAC. After careful examination of the proposal and considering the irrigation requirement of Hubli and Dharwad districts, theCommittee recommends the diversion of 258.00 ha. of forestland for construction of Kalasa Nala Diversion Sche me …"

[Emphasis supplied]

"The proposal was discussed by the Forest Advisory Committee (FAC) in detail. Managing Director of the

User Agency has also presented the case before FAC.

After careful examination of the proposal and considering the irrigation requirement of Hubli and Dharwad districts, theCommittee recommends the diversion of 243 ha. of forestland for construction of Bhandura Nala Diversion Scheme …"

[Emphasis supplied]

2365

It is quite clear that the purpose of the two schemes was to augment the water of Malaprabha reservoir for irrigation only.

1101.

In this regard, the observation of Shri G. M. Madegowda, witness on behalf of the State of Karnataka at Para 14 on pages 11 to 13 and Para 16 on page 14 of his Affidavit dated 9.11.2017 (Volume 207) are also quite relevant. Relevant extract from Para 14 of the Affidavit of Shri Madegowda is reproduced hereunder.

“14. Ever since the project for drawal of water from Malaprabha dam was commenced, there have been conflicts between irrigation demand and drinking water supply more particularly during summer months. The water level in the dam would fall so low from February to June, the drawl of water for drinking water supply would become contentious between City Corporation and the farmers. The farmers of Malaprabha command, farmer organisations and Kannada cultural organisations would resort to protests. The general public of the city

have resorted to dharnas, bundhs, strikes, disrupting the public transport system, etc. This has resulted in drinking water supply getting disrupted. The newspaper clippings reveal about the demonstrations, dharnas, hunger strike sit-ins and city bundhs, occasionally even leading to stoppage of pumping system and water

treatment plants, have been resorted to by the farmers against the drawal of water from the dam. On occasions, the protestors including farmers have addressed representations to the Police Commissioner of Hubli-Dharwad City. Anticipating the law and order trouble, the Chief Engineer, Karnataka Urban Water Supply and Drainage Board has addressed the Police Commissioner for providing security to the water supply and treatment installations at the Malaprabha dam and en-route infrastructure. …"

From the above, it is apparent that the shortage of irrigation water is the major issue and that the diversion schemes are primarily planned to address the shortage of irrigation water in the command of the Malaprabha project. This becomes amply clear from the Statement of Shri Madegowda at Para 16 of his Affidavit (Volume 207), wherein he has stated that "t he diversion from Mahadayi is necessary to relieve the burden on the existing water of Malaprabha dam, which is required for meeting the require ments of command areas, etc.". This aspect has been

examined at Para 1054.

From the foregoing paras, it is evident that the main

objective of the diversion schemes is to augment the water of the

2367

Malaprabha reservoir to address the shortfall in the irrigation water required for the notified areas of Kharif and Rabi etc.

Misplaced Priorities

1102.

The “Modified Detailed Project Report of Malaprabha Project” (Volume 33B) prepared in 2009 and filed by the State of Karnataka, inter-alia, includes information about the different uses of water planned in the earlier DPR approved in 1963 by the Planning Commission for gross utilization of 37.2 tmc and that in the proposed modified DPR of 2009. From Section 2, Salient Features on pages 18 and 19, it is apparent that no provision was made in the earlier approved Project Report of 1963 in respect of domestic water supply at all. However, in the “Modified Detailed Project Report of Malaprabha Project”, a provision of 0.201 tmc only is made towards domestic water supply for “Hubli -Dharwad, Bailhogal, Savadatti and other 14 villages of Savadatti Tq”.

1103.

The Tribunal finds that no explanation / reason is offered by the State of Karnataka or any of the witnesses

examined by it as to why, provision of 0.201 tmc of water only is indicated towards domestic water supply for Hubli-Dharwad,

2368

Bailhogal, Savadatti and other 14 villages of Savadatti Taluk in the salient features at pages 15-35 of the revised DPR of 2009 (Volume 33B). In fact, if Hubli-Dharwad and other villages are water-starved, for domestic water use, adequate and appropriate provision for supply of water for domestic use should have been made and can be made even to-day in the revised DPR of Malaprabha Project. In the said revised project itself, the State of Karnataka should have earmarked 7.56 tmc of water and can be earmarked presently for Hubli-Dharwad and other villages. Admittedly, this was not done by the State of Karnataka and therefore, its claim that 7.56 tmc of water is needed for meeting drinking and other domestic requirements of twin cities of Hubli-Dharwad and other villages becomes, highly

unsustainable.

1104.

At the time of modification of the DPR of Malaprabha Project in 2009, the National Water Policy 2002 and the State Water Policy 2002 of the State of Karnataka were already in place. In both the policies, i.e., the National Water Policy as well the State Water Policy, drinking water is mentioned at first place in the list of water allocation priority. The National Water Policy was revised in the year 2012. In Clause 1.3(vi) of the National

2369

Water Policy of 2012, it is stated that safe water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs (including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system needs. Thus, drinking water continues to be the first priority even in the National Water Policy of 2012. What is necessary to notice, is that a National Water Policy is finalized in the meeting of National Water Resources Council, which is presided over by the Hon'ble Prime Minister.

1105.

The reasons for not indicating the provisions for drinking water purposes in the Salient Features at pages 15 to 35 of the "Modified Detailed Project Report of Malaprabha Project" (Volume 16) of the year 2009 have not been explained despite the fact that: (a) drinking water supply is the first priority as per the National water Policy 2002 as well as the Karnataka State Water Policy 2002; and (b) 0.95 tmc of water from Malaprabha reservoir is being supplied for meeting the drinking water

requirements of the twin city of Hubli-Dharwad.

2370

1106.

Question No. 74 put to Shri A. K. Bajaj, Expert Witness of the State of Karnataka by the learned Senior Counsel for the State of Goa on 14.9.2017 and the reply thereof are reproduced hereunder.

“Q.No.74. In your Affidavit in Evidence as well as in the Report dated 30.12.2016 (Vol.194), page 14, Para 9, you have stated that, as per National Water Policy, the drinking water needs has the highest priority. Similarly, in answer to question No.71 as well, you have stated that drinking water needs have the highest priority as per the National Water Policy. I draw your attention to Vol.33 (B) i.e. the Modified Detailed Project Report of Malaprabha Project, submitted by State of Karnataka on 18.03.2013, more particularly, at page 17 wherein allocation is made for water supply and industrial purpose as per the revised Project Report.

From the said Report it is evident that as per the revised Project Report, the total allocation of water for

industrial and drinking water, taken together is 0.216 TMC out of the total of 27 TMC.

According to you, is this allocation of only 0.216 TMC in accordance with the National Water Policy which you claim to give highest priority to the drinking water?

Ans. At the time of preparing a revised Project Report of an already ongoing project, generally, the existing usages have to be protected. It is probably on this basis

that the allocation have been apportioned. I am not in a position to say as to why or what were the conditions in the command area due to which the Government of Karnataka has given the quantities for the purposes as mentioned in the Vol. 33(B) at page 17. Based on the information contained in the Volume 33(B) at page 17, I am not in a position to say whether the allocations are justified or not."

1107.

It is however, noted that at page 135 of the "Modified Detailed Project Re port of Malaprabha Project" (Volume 33B), a Note on Working Table is given. In this Note, the following has been stated in respect of requirements of drinking water supply for twin cities of Hubli-Dharwad. The relevant extract is as under:

"…

The requirement of Drinking water supply of 90 MCft monthly for Twin cities of Hubli-Dharwad has been provided from the year 1982-83. Thus under Col. No. 7 of working table issues for irrigation and drinking is

shown as 25340 MCft annually (24260 for irrigation + 1080 MCft (90 MCft X 12 months)). As regards, to issues for water other requirements on the downstream of dam under Col. No. 8 is actual yearly issues during the year 1973-74 to 2005-06. This requirement is however not accounted for utilization under Malaprabha Project. This drinking water requirement for Twin cities of Hubli-Dharwad which is lifted directly from reservoir as duly considered for utilization under Malaprabha Project."

2372

1108.

From above, it is safe to conclude that although there is no specific mention about the provision for drinking water supply to twin city of Hubli-Dharwad from the Malaprabha reservoir in the Table indicating Salient Features of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B), a provision of 1.08 tmc (1080 million cubic feet) has been duly accounted for drinking water supply for twin city of Hubli-Dharwad from the Malaprabha reservoir.

Inefficient Use of Irrigation Water

1109.

The State of Goa in its pleading has mentioned at Para 174, page 198 of the Statement of Case of the State of Goa (Volume 131) that the Government of Karnataka is merely using the pretext of drinking water needs to Hubli and Dharwad as a bogey for diversion of waters from the Mahadayi basin and alteration of profile of Mahadayi River and that in reality, the purpose is to utilize the waters from the Malaprabha basin

entirely and excessively for irrigation purposes, particularly for cash rich crops like, sugar cane. The State of Goa has further stated that the area under sugarcane cultivation and the sugar

2373

production in the Malaprabha basin from the years 1972 – 2013 has drastically increased. It is stated at Para 174(i) of the Statement of Case of the State of Goa (Volume 131) that the area under sugarcane cultivation in the said basin for the year 1979-80 was 224 hectares and it has risen to 2756 hectares in the year 2012-13, which is an increase by more than 12 times. Para 174(i) of the Statement of Case of the State of Goa (Volume 131) is reproduced hereunder.

“174. (i) The state of Goa submits that the area under sugarcane cultivation and the sugar production in the Malaprabha basin from the years 1972 – 2013 has drastically increased. For instance, the area under sugarcane cultivation in the said basin for the year 1979-80 was 224 hectares. It has risen to 2756 hectares in the year 2012-13, which is an increase by more than 12 times.”

1110.

The State of Karnataka, in the “Reply on behalf of the State of Karnataka (as amended pursuant to the Order dated

15.4.2015 passed by the Hon'ble Tribunal) to the Amended Statement of Case of Goa dated 23.4.2015" (Volume 131) has stated that the contents of Para 174 of the Statement of Case of the State of Goa are outside the Reference made to the Tribunal. The State of Karnataka has denied that the Government of

Karnataka is merely using the pretext of drinking water needs to Hubli and Dharwad as bogey for diversion of waters from the Mahadayi basin and alteration of profile of Mahadayi River. It has further been denied that the purpose is to utilize the waters from the Malaprabha basin entirely and excessively for irrigation purposes, particularly for cash rich crops like sugarcane.

1111.

State of Goa has also mentioned at Para 174(ii) that it appears that the State of Karnataka has not stopped issuing permissions even for the setting up of new sugar factories in the said region thereby promoting cultivation of water guzzling crops such as sugarcane in the said region.

1112.

In response to Para 174(i) of the Amended Statement of Case of the State of Goa, the State of Karnataka has stated at Para 5.130A of Volume 138 that “the sugarcane cultivation in Malaprabha basin in Karnataka has increased by conjunctive utilization of surface water drawn from the canals or river lifts and gro und water”.

1113.

The case of State of Goa is that the farmers in

Karnataka have resorted to raising cash crops, like sugarcane,

which need more water and have abandoned Kharif and Rabi crops, which were approved crops as per the modified Detailed Project Report of Malaprabha Reservoir. Therefore, it is necessary for the Tribunal to understand as to what is sugarcane and what is the requirement of water for raising crop of sugarcane.

1114.

As per “Handbook of Agriculture” published by the Indian Council of Agricultural Research (MARK-12), sugarcane along with cotton, tea, tobacco and jute and mesta are the major commercial crops. It is stated in the “Handbook of Agriculture” that sugarcane contains 12-15% sugar (sucrose, glucose and fructose), and 80-90% of its production is used for manufacturing white sugar, jiggery (*gur*)and *khandsari* .Regarding the irrigation requirement for sugar cane, the “Handbook of Agriculture” states as under.

“In sugarcane, maintenance of optimum soil moisture during all stage of crop growth is one of the essential requisites for obtaining high yield. The crop should,

therefore, be grown in areas of well-distributed rainfall or under assured and adequate irrigation .In tropical India, depending on the type of the soil, seasonal conditions, variety grown, method of planting and rate

of manuring, total water requirement of the crop for optimum growth varies from 2,000 to 3,000 mm, inclusive of rainfall. The requirement of *adsali* cropis proportionately higher (3,200 to 3,500 mm). …"

[Emphasis supplied]

From above discussions, it is apparent that sugarcane is a cash crop, it consumes lots of water and that it should be grown in areas of well-distributed rainfall or under assured and adequate irrigation.

1115.

The learned Senior Counsel for the State of Goa had also put question No. 84 on 15.9.2017 to Shri A. K. Bajaj, Expert Witness of the State of Karnataka. The question No. 84 and the reply thereof are as under.

"Q.No.84. Malaprabha basin is indeed a sub -basin of Krishna. In the award rendered by the Hon'ble KWDT, 44 TMC of water has been awarded in favour of Malaprabha reservoir. At the time of the initial estimation of yield in the Malaprabha reservoir,

cultivation of sugarcane crop, was on the rise in the North Karnataka region. In volume 86, which are answers on behalf of the State of Karnataka to the interrogatories of State of Goa, at Annexure I thereof at page 11 therein, State of Karnataka has given the figures of area irrigated under Malaprabha reservoir

from 1979-80 to 2012-13. At column 1 in S. No. 1, the figure for 1979-80 for sugarcane is shown as 224 Ha. For the year 2009-10, the sugar cane cultivation figure has risen up to 3038 Ha., and in the years 2010-11 it has gone up to 3421 Ha.

In annexure-2, the figures given by the Office of the Cane Development Commissioner and Director of Sugar are reflected. At S. No. 3 on page 12 of the very said document, the sugarcane demarcated/ allocated Taluka-wise/District-wise for Sugarcane development for each of the existing and proposed sugar factories in command of Malaprabha reservoir are given vide Annexure-I and Annexure-II thereof, at page 13 of the said document namely Vol. 86. In the five factories, the area allocated for sugarcane development of the existing factories works out to 24827 Ha. Apart from this in the Table below on the same page, another five proposed sugarcane factories are reflected. In addition, there is Annexure-III and Annexure-IV also, wherein

areas are mentioned.

In the modified DPR of Malaprabha project at Vol.33 (B), there is no whisper about sugarcane cultivation or the area allocated for the same.

In your report annexed to the Affidavit dated 30.12.2016 (Vol. 194), you have dealt at page 11 therein, with the hydrology of the Malaprabha reservoir. You have chosen, perhaps deliberately, to avoid any reference to Malaprabha basin as such or its tributaries.

In paragraph 7 of your report at page 12 therein, you have concluded based on the revised DPR of 2009 that Malaprabha reservoir is a deficit reservoir.

2378

Please answer the following questions:-

a. Why have you, instead and in place of dealing with Malaprabha basin and its tributaries, dealt with only the reservoir, conveniently leaving out a large portion to the extent of 80% of the water in the Malaprabha basin?

b. Why have you not dealt with or addressed the issue of large scale untamed and uncontrolled rise in sugar cane cultivation, which consumes the water from the Malaprabha reservoir, in your report?

c. Did you, before undertaking or carrying out the study which has culminated in the report, undertaken an enquiry as regards 2009 modified DPR vis-à-vis the answers given in Volume 86 by the State of Karnataka which display figures from 224 Ha. in 1979-80 to 3038 Ha. in 2009-10, as also the other figure of 24827 Ha. as mentioned herein above?

Ans. My answer to specifically paras (a) to (c) of the

question are as follows:-

a. I have dealt with the water available in the Malaprabha Dam Reservoir as, this is the utilisable water. For harnessing the water flowing in the rest of the basin, proper infrastructure will have to be provided.

b. I was discussing the limited issue of reduction in the flows to the reservoir in my report and not the cropping pattern in the command. As such, I have not addressed the issue of cultivation of sugarcane in the command in my report.

2379

c. No, as mentioned in (b) above, I did not undertake the detailed study of the sugarcane figures ranging from 224 Ha. in 1979-80 to 3038 Ha. in 2009-10 or the worked out figure of 24827 Ha. mentioned by the Cane Development Commissioner allocated to the five factories."

1116.

In this regard, the cropping pattern mentioned at page 33 of the Salient Features of the Modified DPR of Malaprabha Project (Volume 33B), are shown hereunder.

Name of Crop (Season-wise)	Percentage area (CCA) Kharif (30%) Rabi (53%) Two seasonal (15%)	Kharif		Change in cropping
		Existing (94%)	Proposed (100%)	
Local Jawar		28.00		
Hybrid Maize			67	
Bajra				

Ground nut		6.50	27	
Hybrid Jawar			6	
Wheat		23.50		
Cotton		36.00		

1117.

A bare perusal of the above mentioned Table makes it evident that sugarcane was never included in the approved

cropping pattern. Therefore, the Tribunal finds it safe to record a conclusion that cultivation of sugarcane is in violation of the cropping pattern mentioned in the Modified DPR of Malaprabha Project (Volume 33B). What is interesting to note, is that Malaprabha Project in the Naviluteertha in Belagavi District, in Karnataka was completed in the year 1974. The DPR was then revised in the year 2009, which is produced by the State of Karnataka at Volume 33B. A comparison of the salient features of these two project formulations, clearly demonstrates that as per the original approved DPR, the annual water availability at 75% dependability was assessed at about 47 tmc, whereas in the revised DPR, the yield is reduced to about 27 tmc. What is shocking is the fact that, for a yield of about 47 tmc, the proposed gross irrigated area was 1,21,408 hectares, but in the modified DPR when the yield was reduced to about 27 tmc, the gross irrigated area inexplicably has been increased to 1,96,132 hectares. That is evident, if one refers to Item 6.c(vi) at page 18 of the Modified DPR of Malaprabha Project (Volume 33B). Such a high increase in agriculture command is neither explained by the

State of Karnataka in any of its pleadings nor an attempt is made to explain such a high increase in irrigated area, by any of the witnesses examined on behalf of the State of Karnataka.

2381

1118.

Shri Chetan Pandit, in his Additional Affidavit dated 12.9.2016 (Volume 192) has categorically mentioned on oath that as per reply provided by the State of Karnataka to the interrogatories administered by the State of Goa, it is clear that in Malaprabha command, the area under sugarcane cultivation has increased from 224 hectares in the year 1979-80 to 2756 hectares in the year 2012-13. Thus the agricultural activities have been extended to a great extent and cash crop like sugarcane is supported by the State of Karnataka, for which no satisfactory explanation is furnished either by the State of Karnataka in its pleadings, or by any of the witnesses examined on behalf of the State of Karnataka.

1119.

In a book titled “Water Governance in Motion – Towards Socially and Environmentally Sustainable Water Laws” Edited by P. Cullet, A. Gowlland-Gualtieri, R. Madhav and U. Ramanathan, it is stated at page 66 as under.

“There is also inequity in the distribu tion of water both

between districts and within the same district. For instance, sugarcane-growing areas get water even during droughts, while other areas lack water for subsistence crops or even drinking water. Sugarcane

cultivation is problematic not only in terms of equity, but also in terms of environmental sustainability. Increased cultivation of sugarcane usually has gone hand-in-hand with lavish use of water for irrigation and use of fertilizers in excessive amounts (which further increases need for water), and has resulted in water logging and salinity in many areas. It is also important to note that the problems of efficiency, equity, and sustainability of water are inter-related. For instance, the growing problem of ground water depletion means that the newer technology needed for pumping water is increasingly less accessible to poor farmers, resulting in inequity in the way different classes of people can cope with groundwater shortage."

1120.

Shri Chetan Pandit, in his Additional Affidavit, filed on 12.9.2016 (Volume 192) has mentioned that even new sugarcane factories are coming up in Dharwad District, which means that the new industries would also require and use more quantity of

water. For adopting such a disastrous approach, neither any explanation has been offered by the State of Karnataka in its pleading nor has any explanation been offered by any of the witnesses.

1121.

Further, the industrial profile of Dharwad District is mentioned in great details by Shri Chetan Pandit in Para 98 of his Additional Affidavit, filed on 12.9.2016 (Volume 192), which also

shows that more industries are being promoted by the State of Karnataka, instead of meeting the drinking water needs of Hubli-Dharwad, en-route villages, etc.

1122.

The Tribunal acknowledges the right of the State of Karnataka to develop its economy in whichever way it wants. However, the National Water Policy and the State Water Policy enjoins upon the State of Karnataka to plan the same based on the water resources available in each basin. There is no manner of doubt that the State of Karnataka has committed blatant violation of provisions of National Water Policy as well as State Water Policy by: (i) increasing the irrigated area; (ii) supplying water to a great number of industries; and (iii) by supporting cash crops of agriculture particularly sugarcane, instead of supplying drinking water to meet the needs of Hubli-Dharwad twin city and en-route villages etc. This will have to be regarded as a breach of Article 21 having been committed by State of Karnataka.

1123.

From the foregoing paras, it is apparent that: (a) there

are considerable inconsistencies in information; (b) at the time of planning of the schemes for diversion of 7.56 tmc of water from Mahadayi river basin to Malaprabha reservoir, all facts were not

taken into consideration; such as change in cropping pattern, conjunctive use of surface water and ground water in Malaprabha basin, and cultivation of sugarcane on large scale etc., for harnessing, the water flowing in the rest of Malaprabha basin proper infrastructure will have to be provided and once, such proper infrastructure is provided, Karnataka would be able to adequately meet, drinking needs of twin city and other villages and its claim for diversion for 7.56 tmc of water from Mahadayi river, would, no longer subsist, and (c) all related issues have not been adequately addressed. The Tribunal is of the opinion that major portion of diversion of 7.56 tmc of water is only for irrigation purposes and not for drinking and other domestic needs of Hubli-Dharwad and other villages.

1124.

From the facts emerging from the aforesaid paras, the Tribunal concludes that the State of Karnataka has miserably failed in addressing the water related issues of the north Karnataka region. The Tribunal finds that there is no shortage of drinking water in twin city at all and diversion of water is sought

only for the purpose of irrigation. If the State of Karnataka had approached the Tribunal with clean hands and had demanded water for irrigation, for the areas located in North Karnataka, it

would have been easier for the Tribunal, to deal with such a demand. Engineers and Officers responsible for planning and managing the water resources facilities have failed on many counts, which inter-alia include:

a. Inappropriate planning of Malaprabha project with over-estimation of available water resources, and thereby creating huge facilities and high hopes to the people of the region;

b. Non-adherence to the principles of prioritization in water allocation and not making adequate provisions for drinking water supply in modified detailed project report of Malaprabha project in the year 2009 despite the drinking water needs being the topmost priority in the National Water Policy as well as the State Water Policy;

c. Ignoring the factual position of water uses, particularly that in respect of drinking water for the Hubli-Dharwad twin city while modifying the detailed project report of Malaprabha project in the year 2009;

d. Promoting the water guzzler crops like sugar cane etc. in

the command of Malaprabha project fully knowing the facts that the region suffers from water scarcity; and

2386

e. Not ensuring efficient management of water resources, particularly the lack of proper maintenance of the created facilities for water supply.

1125.

On behalf of the State of Goa, an Article dated 23.01.2014 downloaded from web site is relied upon to demonstrate that on the basis of advice given by Legal Panel of the State of Karnataka, the claim for drinking water does not exist at all and that, in fact, demand of water from Kalasa-Bhandura is only for irrigation purposes. In support of their claim, the Learned Counsel for the State of Goa has relied upon Annexure – C appended to the “Rejoinder on behalf of the State of Goa to the Reply dated 25.5.2015 filed by the State of Karnataka to Amended Statement of Case of Goa” dated 30.6.2015 (Volume 150).

1126.

There is no doubt that the said downloaded Article refers to the advice given by the Legal Panel of the State of Karnataka. However, the Tribunal finds that no question relating

to this Article was put by the State of Goa to any of the witnesses examined on behalf of State of Karnataka. Further, Annexure – C of the Rejoinder dated 30.6.2015 is not proved by any of the

witnesses examined on behalf of the State of Goa. Therefore, the Tribunal is of the opinion that on the basis of the advice, contained in the Article, it is difficult to come to the conclusion that the demand of water is for irrigation and not for drinking purposes, though, earlier on appreciation of the evidence, the Tribunal has recorded a firm finding of the fact that in fact the demand for water is for irrigation and not for drinking purposes.

1127.

The Tribunal is convinced that the failure on part of the State Government, its high officials and engineers in proper planning and management of water resources of the region, has led to the present crisis where the people residing in the north Karnataka region are facing considerable inconveniences and are deprived of the adequate supply of water for survival as also for livelihood. The situation resulting from highly casual approach to planning of water resources projects, has led to various problems including social conflict of serious nature, as is apparent from averments made by Shri G. M. Madegowda (RW4) at para 14, page 11-12 of his Affidavit (Volume 207), which is reproduced

hereunder once again.

“14. Ever since the project for drawal of water from Malaprabha dam was commenced, there have been conflicts between irrigation demand and drinking water supply more particularly during summer months. The water level in the dam would fall so low from February to June, the drawal of water for drinking water supply would become contentious between City Corporation and the farmers. The farmers of Malaprabha command, farmer organisations and Kannada cultural organisations would resort to protests. The general public of the city have resorted to dharnas, bundhs, strikes, disrupting the public transport system, etc. This has resulted in drinking water supply getting disrupted. Thenewspaper clippings reveal about the demonstrations, dharnas, hunger strike sit-ins and city bundhs, occasionally even leading to stoppage of pumping system and water treatment plants, have been resorted to by the farmers against the drawal of water from the dam. On occasions, the protestors including farmers have

addressed representations to the Police Commissioner of Hubli-Dharwad City. Anticipating the law and order trouble, the Chief Engineer, Karnataka Urban Water Supply and Drainage Board has addressed the Police Commissioner for providing security to the water supply and treatment installations at the Malaprabha dam and en-route infrastructure. …"

[Emphasis supplied]

In this regard, the Q.No.6 put to Shri Madegowda by the Tribunal and the answer thereof are reproduced hereunder.

2389

“Q.No.6.

…

In this regard, please answer the following:

a. When the provisions of the State Water Policy and National Water Policy are very clear in respect of highest priority to be accorded to the water needs for drinking purposes, how can there be a conflict?

b. How the drinking water supply got disrupted and what actions had been taken by the administrative machinery?

c. What measures have been taken to ensure that there are no such conflicts in future?

Ans. I wish to answer the question in three parts:

a. Citizens of Hubli-Dharwad Municipal Corporation limits, and population of the towns and villages of the area are provided water supply to the extent of 1.98 TMC per year. When that quantity of water is drawn, farmers agitate and claim that they want to grow various crops and their livelihood is

affected. But still water is supplied to the residents of Hubli-Dharwad areas.

b. Because of the agitations, there were interruptions in the drinking water supply, but the State administrative machinery and the Police Department had given protection to the installations whenever any such protests emerged.

c. These are administrative matters to be considered at the State level."

The serious nature of the conflict is apparent from the averments made by the witness (RW4) whereas the reply to specific question is indicative of the casual and slipshod approach adopted by the State of Karnataka. Providing police protection to the installations can only be considered as an ad-hoc arrangement. From reply of Shri Madegowda (RW4), it is apparent that no serious effort has been made to find a lasting solution to the conflict of this nature. Unfortunately, the learned Counsel appearing on behalf of the State of Karnataka also did not address the issue in proper perspective during the course of arguments.

The Tribunal is convinced that an important reason for emergence of conflict of this nature, is the highly casual approach of the State of Karnataka in planning of its water resources without realistic assessment of the available resources and due consideration of all related social, economic and ecological issues, which has led to a situation of creating false hopes to people. When the false hopes created fall to the grounds, the people affected become frustrated and resort to sits-in, holding

of demonstration, violence, etc., which are not congenial to a

civilized society at all. Nevertheless, it remains a fact that for people of this region, agriculture is the main occupation and dependence on the availability of water is very crucial for their survival. With the realization that the water availability as planned through the Malaprabha Project would be less than the expectation, there are worries and resentment which is apparent from the agitation of the local people. A scant reference to the agitation is made by Shri Madegowda (RW4) in his Affidavit. The fact that the agitation is going on since long was not seriously disputed by the State of Goa.

During the visit of the Tribunal to various Projects/Sites, a number of delegations representing various sections of the Society also met the Tribunal in the presence of the Legal Teams of the three co-basin States, namely Goa, Karnataka and Maharashtra at Belgaum on 19th December 2013 and Hubli on 21st December 2013. While a patient hearing was given to all the delegations, it was made very clear to them that as per the laid down procedure, the proceedings of the Tribunal would be based strictly on the pleadings made by the three States, namely, Goa,

Karnataka and Maharashtra.

2392

1128.

The Tribunal also takes note of the fact that the Malaprabha basin gets relatively lower rainfall as compared to the rainfall in the adjoining Mahadayi basin. The relevant portion from para 2.4, pages 47- 48 of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B) is extracted hereunder.

“…

The catchment area lies leeward side of the Western ghats. Abnormal variations of rainfall & temperature could be noticed from high hill slopes to the plains near dam site. The Climatic conditions prevailing in the Project area is that of the Western ghats and Malnad region – consisting of mountains and forested area covering parts of Belgaum in its upper reaches with elevation ranging from 660 to 1100m and the Northern Malnad region – the elevation ranges between 650 to 350m above MSL. Generally the area experiences dry climate with temperature varying from a low of about

20°C in the winter to high of about 45°C during summer.

The average annual rainfall in the project area varies between 450 to 600 mm. …"

[Emphasis supplied]

On the other hand, the average annual rainfall in the adjoining Mahadayi catchment area is relatively of very high order i.e. 3800 mm to 5700 mm, as is apparent from para 27,

page 40 of the “Statement of Case of the State of Goa” (Volume 131), which is reproduced hereunder.

“27. Thecore catchment area of the Mahadayi lies in the heavy rainfall (3800mm-5700mm per annum) thickly forested, approximately 200 sq. km of mountain topography of Khanapur taluka barely 10 km. upstream of Valpoi in Goa. A very large quantity of water that flows down the Mandovi all the year round originates in the streams and rivulets around Kankumbi, Jamboti, Talewadi, Gavali and Hemadga villages where Karnataka’s diversion and hydroelectric dams are to come up. …”

The extent of variation in the rainfall in the two regions is also apparent from the report titled “Rainfall Statistics of India – 2016” [Report No. ESSO/IMD/HS/R.F.REPORT/01(2017)/23] of the India Meteorological Department (Ministry of Earth Sciences). It provides the Subdivision-wise Normal Annual Rainfall in Table 33 on pages 102-103. As per this Report, the Normal Annual Rainfall for the North Interior Karnataka (N.I.

Karnataka) Subdivision is 740.3 mm, whereas the Normal Annual Rainfall for the Konkan & Goa subdivision is 3101.1 mm. The Tribunal also finds that seven blocks of Belgaum District and four blocks of Dharwad District are included in the list of Drought Prone Area Programme of the Government of India.

2394

1129.

This Tribunal has to ensure that justice is done to the people residing in the region despite the failure on part of the Karnataka Government, its high officials and engineers in proper planning and management of water resources of the region. Accordingly, all related issues, particularly, the hydrology of the basin, the economic and social needs of the people residing in the region, the extent of population dependent on the waters of the basin, sustainability of the resources and related ecological aspects have been considered by the Tribunal in broader perspective.

In this regard, it is noted by the Tribunal that the Supreme Court, in its Judgement of 16.2.2018 in Civil Appeal No. 2453 of 2007 on Carvery issue has referred to the Helsinki Rule and at para 306 of judgement, the Article V of the Helsinki Rule which enumerates the relevant factors, to be taken into consideration has been quoted. The Supreme Court has put emphasis on the following three factors.

- 5.The economic and social needs of each basin state

- 6.The population dependent on the waters of the basin in each basin state
- 8.The availability of other resources

2395

In para 367 of its judgment, the Supreme Court has, inter-alia, observed as under.

"… The said principles can be regarded as functional dynamics while equitable distributing the water in an inter-State river disputes. The salient feature of all these factors has to have inherent variability and inevitable flexibility thereof having regard to the local conditions, for it is difficult to ignore the undeniable and common emphasis necessary to ensure beneficial use of the available resources for a basin state and logically for its dependent populace warranted by the economic and social needs. Beit stated, while determining the said needs, amongst others, past and existing utilization of the water have to be borne in mind. To remain oblivious to the same would amount to playing possum with the doctrine of equitable distribution *inpraesenti* . The noticeable quintessence of the determinants is the predication for a delicate balance in adjustments of the needs based on realistic, reasonable, judicious and

equitable canons so much so that while satisfying the requirements of a basin state, a co-basin state is not subjected to any substantial injury. Thoughin terms of Articles VI and VII, any other category of users is not entitled to any inherent preference over any other use or category of users, yet the precedence of an existing reasonable use of a basin state over a proposed future use of a co- basin state has been recognized."

[Emphasis supplied]

2396

In view of above, and with a view to doing complete justice to the people, the Tribunal has undertaken the exercise of balancing in adjustments of the needs, based on realistic, reasonable, judicious and equitable canons, so much so that while satisfying the requirements of a basin state, a co-basin state is not subjected to any substantial injury.

1130.

Some of the important facts related to the proposed demand of water of 7.56 tmc for meeting the drinking water demand of Hubli-Dharwad, en-route villages, etc., which have emerged from the foregoing paras are listed by the Tribunal as under.

a. The present level of availability of water at 75% dependability in the Malaprabha reservoir i.e., 26.76 tmc is far less than the quantum of 47.25 tmc, which was indicated as the water availability at 75% dependability for planning the project in the year 1970.

b. The Government of Karnataka has already initiated measures for improving the water supply infrastructure for

twin city of Hubli-Dharwad to ensure supply of 5.2 tmc of water on 24X7 basis with the assistance of the World Bank.

c. The planning for improving the water supply infrastructure for twin city of Hubli-Dharwad corresponding to 5.2 tmc indicates that the long term future water requirement for twin city of Hubli-Dharwad is 5.2 tmc only and not 6.63 tmc (the projected domestic water demand of Hubli-Dharwad twin city out of total demand of 7.56 tmc).

d. Measures have been taken by the Government of Karnataka to minimize the wastage of water through leaks in water supply pipe network etc. and it has shown positive results.

e. There is scope for more efficient use of water through demand side management.

f. The Modified Detailed Project Report of Malaprabha Project (Volume 33B) has, duly accounted for 1.08 tmc of water, for Hubli-Dharwad although the same is not reflected in the Salient Features of the DPR.

g. From the information included in “Report on Drinking Water Demand of Hubli-Dharwad, En-route villages, etc. from Malaprabha reservoir” (Vol 16), it is apparent that at

present, 1.98 tmc of water is being withdrawn from the Malaprabha reservoir for twin city of Hubli-Dharwad. Shri Madegowda, the witness of the State of Karnataka has also

indicated so in answer to question No. 3, put to him by the Tribunal.

h. If the present level of withdrawal of 1.98 tmc of water in the year 2017 is considered, the additional future requirement for Hubli-Dharwad twin city only, works out to be about 3.22 tmc. Even with addition of demands of water of (a) 0.65 tmc for livestock, (b) 0.21 tmc for domestic water for enroute villages, and (c) 0.07 tmc for Kundagol town, the overall demand would not be more than 4.08 tmc. With allocation of 1.08 tmc as indicated in the Modified Detailed Project Report of Malaprabha Project (Volume 33B), the additional future requirement for Hubli-Dharwad twin city only, works out to be about 4.12 tmc.

Estimate of Water Availability at the Proposed Diversion Sites

1131.

The Government of Karnataka has proposed to divert 7.56 tmc of Waters of Mahadayi river basin to Malaprabha reservoir from two sites namely, proposed Bhandura dam site and the proposed Kalasa dam site. The catchment area at the

proposed Bhandura dam site is 32.23 sq. km. In addition, waters from the catchment area of 25.50 sq. km. of proposed Kalasa

2399

dam (including the catchment areas of proposed Kalasa dam site, Haltara diversion and Surla diversion) is proposed to be diverted at from Kalasa dam site.

1132.

The availability of water resources at the proposed Bhandura dam site and proposed Kalasa dam site at 75% dependability assessed: (a) in the respective DPRs of Bhandura and Kalasa projects; (b) in the Report of Prof. A. K. Gosain (Volume 193); (c) in the Report of Shri Chetan Pandit (Volume 196); and (d) by the Tribunal vis-à-vis the proposed diversion by the State of Karnataka is summarized in the following Table.

Table-1:

Estimated Water Availability at 75% Dependability at Proposed Bhandura and Kalasa Dam Sites

Sl. No.	**Description**	**Proposed Bhandura Dam Site**	**Proposed Kalasa Dam Site**	**Total**
		Bhandura	**Kalasa**	
1.	Project Reports of	4.136	2.71	6.846

Kalasa and Bhandura

project of the Year 2000

(Volume 17 & 20)

2. Project Reports of the 2.4 3 5.4

Year 2012 / 2010

(Volume 19 & 21)

3. Report of Prof. A. K. 3.7 3.8 7.5

Gosain (Volume 193)

4. Report of Shri Chetan 1.50 1.98 3.48

2400

5.

Pandit (Volume 196)

Assessment by the

Tribunal

Diversion Proposed by

the State of Karnataka

2.77

4.00

2.19

3.56

4.96

7.56

1133.

From the particulars, mentioned in above Table, it is most apparent that the water availability at 75% dependability at the proposed sites of Kalasa-Bhandura diversion project is not adequate at all to meet the projected demand. As a matter of fact, a specific quantum of water is necessarily required to be considered towards environmental flow for the downstream

reaches and has to be deducted from the overall water available at these sites.

1134.

Whenever, a project is taken up for diversion of water for various uses, the flow in the downstream reaches of such diversion gets reduced and adversely impacts the ecology of the river in the downstream reaches of the river which inter-alia affects the forests, wildlife etc. In order to minimize the adverse impacts, a specific quantum of flow is required to be ensured for the downstream reaches, which is to be assessed in the form of environmental flow. With reference to the proposed projects for diversion of water of Mahadayi river basin, environmental flow is

essentially required to minimize the adverse impacts of such diversions in the downstream reaches within the territory of the State of Karnataka as also that in the State of Goa. The Tribunal observes that on the important issue of environmental flow, the State of Karnataka has neither uttered a word in its pleadings nor examined any witness. The Tribunal also notices that the State of Maharashtra has also neither addressed this vital issue through its pleadings nor examined any witness in this regard.

1135.

The State of Goa has flagged this important issue in its pleading. The State Goa has also examined an expert witness in this regard. Shri Rajendra P. Kerkar, Expert Witness of the State of Goa recommended a procedure for estimating the environmental flow based on the Research Report No. 107 of International Water Management Institute (IWMI) , titled ‘ An Assessment of Environmental Flow Requirements of Indian River Basins’ by V Smakhtin and M Anputhas [MARK -GOA/35(Colly)]. This has been examined in details at paras 1036 to 1038 and the Tribunal has not accepted the recommendations of Shri Rajendra

P. Kerkar, witness of the State of Goa in respect of the procedure suggested for computation of environmental flow.

2402

1136.

In the absence of any reliable assessment of environmental flows by the party States, the environmental flow has been computed by the Tribunal in accordance with the provisions in the “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Cle arance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015. Thereafter, the upper limit of the quantum of water that could be considered for consumptive uses within the Basin and / or diversions depending upon the needs, has also been assessed and the same is indicated in the Table-2 prepared by the Tribunal as per the procedure indicated at page 48 of the “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environmental Clearance under

EIA

Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015 (MARK-37).

Table-2:

Estimate of Environmental Flow and Upper Limit of the Quantum of Water that could be considered for Consumptive Uses within the Basin and / or Diversions to Malaprabha Reservoir

Description	**Proposed Bhandura Dam Site**	**Proposed Kalasa Dam Site**	**Total**
Sl. No.			
1.			

Water Availability at 75%

Dependability (as assessed by

4.96

2403

2.

3.

4.

the Tribunal)

Water Availability at 90%

Dependability (as assessed by

the Tribunal)

Environmental Flow @ 30% of

the Water Availability at 90%

Dependability (the flow at

proposed sites of diversion being

only during the monsoon period)

Upper Limit of the Quantum of

Water that could be considered

for Consumptive Uses within the

basin and / or for Diversions

outside the basin

1.96

1.55

3.51

0.59

0.47

1.06

2.18

1.72

3.90

1137.

Therefore, the quantum of water that could be considered for consumptive uses within the basin and / or diversion from the two proposed projects namely, proposed Bhandura dam and proposed Kalasa dam cannot be more than 2.18 tmc and 1.72 tmc respectively after deducting need for environmental flows.

1138.

Keeping in view the overall scenario related to water availability, water needs, water demands, essential requirements towards environmental flow etc., the Tribunal is of the opinion that the State of Karnataka would be entitled to divert 2.18 tmc at proposed Bhandura dam and 1.72 tmc of water at proposed Kalasa dam, subject to fulfilling of following directions.

a. The State of Karnataka shall undertake fresh planning and development of scheme for consumptive uses within the basin and / or diversion outside the basin including the reservoir losses etc. for not more than 2.18 tmc at the proposed Bhandura dam site; and

b. The State of Karnataka shall undertake fresh planning and development of scheme for consumptive uses within the basin and / or diversion outside the basin including the reservoir losses etc. for not more than 1.72 tmc at the proposed Kalasa dam site. This will necessarily include the undertaking of the exercise for re-designing of the existing structures in consultation with Central Agency and undertaking works according to revised plan and design.

It is further noticed that such utilizations would necessarily require thorough review and modification of the detailed project reports by the State Government. Therefore, it is directed that the State of Karnataka shall prepare modified detailed project reports (DPRs) for diversion of water from Mahadayi River. It is also clarified that the proposals in the form of detailed project

reports would be considered for implementation only: (a) after

technical appraisal of the proposed projects by the central agencies; and (b) after obtaining all mandatory clearances as required by law.

Diversion of 5.527 tmc of Water from Mahadayi River Basin to Supa Reservoir on Kali River

1139.

The State of Karnataka has also proposed diversion of 5.527 tmc of water at 75% dependability to Supa reservoir of the Kali Hydro Electric Project to augment the water of Supa reservoir for the purpose of hydropower generation.

1140.

The details in respect of water availability for various schemes at different proposed dam sites for diversions, are provided in Para 5.3, pages 16- 17 of the " Project Report for Diversion of Water from the Mahadayi Basin to Kali Basin (Diggi, Viranjole and Katla- Palna Diversion Schemes)" – Annexure 71 to the Statement of Claims of the State of Karnataka (Volume 54B). The catchment areas and the water availability for the proposed schemes at different dam sites are also examined as indicated in

Table-3, which is as under.

2406

Proposed Schemes and Projects for Diversion of 5.527 tmc of Waters of Mahadayi River Basin to Supa Reservoir on Kali River (as submitted by the State of Karnataka)

Diversion Scheme	**Proposed Dam Site**	**Catchment Area in sq. km.**	**Water availability in tmc**
1. Diggi diversion scheme	a. Bundeli Dam	10.40	1.208
	b. Maranala Dam	5.20	0.604
	Sub-total	15.60	1.812
2. Viranjole diversion scheme	a. Pasal nala 1 Dam	6.20	0.720
	b. Pasal nala 2 Dam	3.30	0.382
	Sub-total	9.50	1.102
3. Katla-Palna	a. Katla Dam	16.10	1.870

diversion

scheme

b. Palna Dam 6.40 0.743

Sub-total 22.50 2.613

Total

47.60 5.527

1141.

Major structures proposed to be constructed for

Table-3:

diversion of 5.527 tmc of water of Mahadayi river basin to Supa

2407

reservoir of Kali project comprise 6 dams as mentioned in Table-3, and 6 water conductor systems namely, (a) diversion tunnel from Maranala dam to Supa reservoir, (b) diversion tunnel from Bundeli Dam to Supa reservoir, (c) Inter-connecting tunnel from Pasal nala 1 Dam to Pasal nala 2 Dam, (d) water conductor system from Pasal nala 2 Dam to Supa reservoir, (e) diversion channel from Palna Dam to Katla Dam, and (f) diversion tunnel from Katla Dam to Supa reservoir.

1142.

The stated objective of the proposed diversion of 5.527 tmc of water from Mahadayi river basin to Supa reservoir is to augment the water of Supa reservoir where the water availability at the time of planning was over-estimated and the present level of water availability is considerably less than what was estimated at planning stage. In this regard, Para 8 on 'Hydrology of Kali Reservoir', pages 13 -14 of the Affidavit dated 30.12.2016 (Volume 194) of Shri A. K. Bajaj, Expert Witness of the State of Karnataka is reproduced hereunder.

"Hydrol ogy of Kali Reservoir:

8. The catchment area at Supa Dam site (Kali Dam) across river Kali which is a west flowing river is 408 sq.miles (1057 sq.kms) and the average yield estimated on the basis of rainfall was 119.84 tmc (3394 M.cum). The construction of the project which

was started in 1971 was completed in 1987. The gross storage capacity at full reservoir level and maximum water level is 147.54 tmc (4178 M.cum) and 151.96 tmc (4303 M.cum) respectively and live storage capacity is 132.73 tmc (3758.4 M.cum). The main components of the project are the Supa Dam with a designed storage capacity of 147.54 tmc and a power house for hydel generation. Again, as in the case of the Malaprabha Dam, the water yield at the time of planning the project appears to have been over estimated andthe Supa Dam has filled only twice out of 29 years (1994 and 2006) since the start of filling in 1984. The recorded average yield is only 95.66 tmc. The power potential with the originally estimated yield and storage created in the Supa Dam is 1255 Mw with a head of 488 mtrs. The maximum annual energy that could be generated is 5605 Mu; but due to shortage of yield the average annual energy generated is of the order of 3600 Mu only by the planned diversion of

water from Mahadayi basin to Kali dam, the total generation could be augmented by 182 Mu.”

[Emphasis supplied]

1143.

From the above, it is noted that the shortfall in the water availability of the Supa reservoir (due to over-estimation at the time of planning) is about 51.88 tmc, which is about 54.2% of the present level of water availability. The proposed diversion of 5.527 tmc is only about 5.7% of the present level of water availability in Supa reservoir. Obviously, the contribution of the

proposed diversion is minuscule as compared to the shortfall resulting from faulty planning of the Project due to over-estimation of water availability at planning stage. Thus, the proposed diversion will not at all be of much help in utilizing the full potential of the Kali Hydro Electric Power Project.

1144.

The diversion of water from the Mahadayi river basin along with the extensive construction activities as detailed in Para 1141 above, is bound to have adverse environmental impacts. The Tribunal notes that the State of Karnataka has not produced any study related to environmental impact assessment (EIA) in accordance with the “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015. Similarly, the detailed project report (DPR) also does not mention about any mitigation measures to be undertaken by the State of Karnataka to address likely adverse impacts of proposed diversion of water and that of extensive construction

activities either in the territory of the State of Karnataka or in the territory of the State of Goa.

2410

1145.

In this regard, question No. 7, put on 29.11.2017 to Shri S. M. Jamdar, the Witness of the State of Karnataka by the learned Advocate General of the State of Goa is reproduced hereunder.

“Q.No.7. Please refer to para 12, page 12 of your Affidavit dated 09.11.2017, (Vol. 206) where in, you have stated as under:

“ *Hydropoweris renewable, non- polluting environment friendly source of energy* .”

and

Also refer to para 13, page 13 of your affidavit dated 9.11.2017 wherein you have stated as under:

“ *Itis also the preferred source of power particularly in the context of rising environmental concerns of global warming* .”

It appears that while making these statements you have not taken into consideration the environmental impacts of stoppage of water, diversion, the construction works

including the river diversion works (dams or barrages), water conductor system, control structures, roads, worker colonies and allied works that will need to be undertaken, and all these will have a long term adverse impact on environment.

However, you have conveniently chosen to remain silent on the above mentioned and any other adverse environmental impacts of Hydropower projects.

I, therefore, put it to you that the statement made by you at paras 12 and 13 quoted above is without any

basis, whatsoever, and without conducting any study to that effect, whatsoever. What do you have to say?

Ans. I would reply that while I am not an expert in Hydrology and power engineering, by way of having any professional degree or education and training but I have worked as Managing Director, for nearly three years, of Karnataka Power Corporation Ltd., (KPCL), which constructed, and today owns and operates nearly 4000 MW of hydel power, in the environmentally most difficult areas. We are aware of the environmental issues and we have considered them. We will be able to take care of them as and when situation arises with the relevant Authorities in the Government. ”

[Emphasis supplied]

1146.

The Tribunal also notes that the estimate of quantum of 5.527 tmc of water proposed to be transferred is relatively higher than the assessment made by Prof. A. K. Gosain, the Expert Witness of the State of Karnataka as well as that by Shri

Chetan Pandit, the Expert Witness of the State of Goa. The assessment of needed water, must be determined through a scientific study, as mandated by the National Water Policy, 2012. It is to be noticed that, the State of Karnataka has miserably failed to produce, such a scientific study before the Tribunal, for its consideration. A comparative statement of the assessment of

2412

water availability by Project Authorities, the Expert Witnesses of the State of Karnataka and the State of Goa and that by the Tribunal are indicated in Table-4.

1147.

The quantum of water that could be considered for diversion should have been estimated after accounting for the environmental flows as also the losses from the reservoir and the diversion channels etc. It is apparent that the likely benefits are over-estimated. The assessment of environmental flow suggests that the available water of 4.09 tmc at 75% dependability will have to be reduced by about 1.00 tmc on account of environmental flow alone. Further reduction will have to be made for evaporation and seepage losses from the reservoir and the diversion channels etc. Obviously, the proposal does appear to be of much benefit to the society, particularly if the likely adverse environmental impacts are kept in view.

Table-4:

Comparative Statement of the Assessment of Water Availability for Diggi Diversion Scheme, Viranjole

Diversion Scheme and Katla-Palna Diversion Scheme

2413

Diversion Scheme Proposed Dam Site Water availability (in tmc) as per DPR Water availability (in tmc) as assessed by Prof. Gosain Water availability (in tmc) as assessed by Shri

Chetan

Pandit

Water

availability

(in tmc) as

assessed

by the

Tribunal

1. Diggi

diversion

scheme

a. Bundeli

Dam

b. Maranala

Dam

Sub-total

a. Pasal nala

1 Dam

b. Pasal nala

2 Dam

Sub-total

a. Katla Dam

1.208

0.604

1.812

0.720

1.8

1.0521

1.34

2. Viranjole

diversion

scheme

0.382

1.102

1.870

0.8

0.7320

0.82

3. Katla-Palna

diversion

scheme

b. Palna Dam

Sub-total

Total

0.743

2.613

5.527

2.5

5.1

1.5174

3.3015

1.93

4.09

1148.

While

discussing

the

matters

related

to

“Augmentation of Supa Reservoir” at Para 5.23, on pages 122 - 124 of the (Written Submissions on behalf of the State of Karnataka” (Volume 220), the learned Counsel for the State of

Karnataka referred to a Statement ti tled “NOTE ON STORAGE CAPACITY OF KALI HYDRO- POWER DAM” as Enclosure A -6. At

2414

Para 3(iv), page 196 of the said statement, the following has been stated.

“(iv) Kali Hydro-Power Project being a commercial venture ,naturally, to achieve the above objectives, the storage was envisaged more than average yield.”

[Emphasis supplied]

Thus, the State of Karnataka treats the Kali Hydro-Electric Power Project as a commercial venture.

1149.

It is noted by the Tribunal that the National Water Policy 2012 has well defined priorities in respect of water uses. Relevant paras i.e., Para 1.3 (v) and Para (vi) of the Preamble of the National Water Policy 2012, is reproduced hereunder.

“(v) Water is essential for sustenance of eco -system, and therefore, minimum ecological needs should be given due consideration .

(vi) Safe Water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs

(including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system needs. Available water, after meeting the above needs, should be allocated in a manner to promote its conservation and efficient use."

[Emphasis supplied]

2415

1150.

Para 3 of the National Water Polic y 2012 on the ‘Uses of Water’ is also reproduced hereunder.

“3. USES OF WATER

3.1 Water is required for domestic, agricultural, hydro-power, thermal power, navigation, recreation, etc. Utilisation in all these diverse uses of water should be optimized and an awareness of water as a scarce resource should be fostered.

3.2 The Centre, the States and the local bodies (governance institutions) must ensure access to a minimum quantity of potable water for essential health and hygiene to all its citizens, available within easy reach of the household.

3.3 Ecological needs of the river should be determined, through scientific study, recognizing that the natural river flows are characterized by low or no flows, small floods (freshets), large floods, etc., and should accommodate developmental needs. A portion of river

flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime, including base flow contribution in the low flow season through regulated ground water use.

3.4 Rivers and other water bodies should be considered for development for navigation as far as possible and all

multipurpose projects over water bodies should keep navigation in mind right from the planning stage.

3.5 In the water rich eastern and north eastern regions of India, the water use infrastructure is weak and needs to be strengthened in the interest of food security.

3.6 Community should be sensitized and encouraged to adapt first to utilization of water as per local availability of waters, before providing water through long distance transfer. Community based water management should be institutionalized and strengthen ed."

[Emphasis supplied]

From the above, it is apparent that hydropower

development and that too as a commercial venture, is not at all a priority, within the meaning of National Water Policy 2012, and cannot be approved / recognised by the Tribunal, at all.

1151.

The Tribunal notes that the priority for hydro-power development comes only after safe water for drinking and sanitation, which is considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs (including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system.

2417

1152.

In view of above, the Tribunal is of the opinion that the demand of the State of Karnataka for diversion of 5.527 tmc of water of Mahadayi river basin to the Supa reservoir of the Kali Hydro-Electric Power Project, for generation of hydro-power is not justified at all and cannot be accepted by the Tribunal. The demand/claim for the said diversion of 5.527 tmc of water, is therefore, hereby rejected.

Non-consumptive Use of 13.437 tmc of Water from Mahadayi River Basin at 75% dependability for Hydro-Power Generation through Mahadayi Hydro Electric Power Project at Kotni

1153.

The State of Karnataka has proposed utilization of 13.437 tmc of waters of Mahadayi river basin for in-basin development of water resources for hydro-power generation through Mahadayi Hydro Electric Power Project at Kotni. In addition, consumptive use of 1.5 tmc for irrigation, drinking water and other uses has also been proposed through the said project. The aspect of consumptive use of 1.5 tmc has already

been examined in paras 1049 and 1050 above, and the Tribunal has found the proposal of, consumptive use of 1.5 tmc of water from Mahadayi Hydro Electric Power Project as future use within the basin can be granted and in fact is granted.

1154.

The proposed use of 13.437 tmc of water for hydropower generation is non-consumptive use. In principle, the non-consumptive use of water for hydropower generation within the basin can be agreed without any hesitation, provided it does not alter the river flows adversely, in the downstream reach.

1155.

It is noted that the water availability at 75% dependability at the proposed Kotni dam site has been indicated as 14.564 tmc in the statement for salient features at page 15 of the “Project Report of Mahadayi Hydro Electric Power Project” – Annexure 70 to the Statement of Claims of the State of Karnataka [Volume 54(a)].

1156.

However, the water availability at the Kotni dam site has also been assessed by Prof. A. K. Gosain, Expert Witness of the State of Karnataka and Shri Chetan Pandit, Expert Witness of the State of Goa. It is found that there are considerable variations in the values of water availability at 75% dependability

at the Kotni Dam site. While the water availability at 75% dependability has been assessed as 10.6 tmc by Prof. Gosain, Shri Pandit has assessed the water availability at 75% dependability

as 6.588 tmc only. The Water availability at the proposed Kotni Dam site has also been assessed independently by the Tribunal.

1157.

The values of water availability assessed by the Project Authorities, Prof. Gosain, Shri Pandit and that by the Tribunal are presented in Table-5.

Table-5:

Comparative Statement of the Assessment of Water Availability at Kotni dam site (for independent catchment area of 93.19 sq.km.) by the project authorities and the Expert Witnesses of the States of Karnataka and Goa.

Sl. No.	Description	Assessed value of Average Water Availability (in tmc)	Assessed value of Water Availability at 75% Dependability (in tmc)
1	As per Detailed Project Report [Volume 54(a)]	17.163	14.564

2	As per Report of Prof. A. K. Gosain [Volume 193]	14.3	10.6
3	As per Report of Shri Chetan Pandit [Volume 196]	8.626	6.588
4	As per Assessment by the Tribunal	9.76	8.02

2420

1158.

The Tribunal notices that the hydrological data have been observed by the State of Karnataka at Chapoli site (with catchment area of 124.4 sq.km.). It is found that the average value of the annual water availability on the basis of observed data at Chapoli is about 377.43 Mcum or 13.32 tmc. Using the average annual water availability of 13.32 tmc from the catchment area of 124.4 sq.km, the average annual water availability for the independent catchment of Kotni dam (with catchment area of 93.19 sq.km.) works out to be 9.98 tmc on area proportion basis. This value of 9.98 tmc, estimated by the Tribunal, on the basis of observed discharge data at the Chapoli site of the State Government of Karnataka, matches very closely with the average water availability of 9.76 tmc assessed by the Tribunal and indicated in Table-5 above.

1159.

In view of the above, it is considered necessary that the project features must be revised in the light of the revised assessment of water availability as 8.02 tmc at 75%

dependabil ity and not 14.564 tmc indicated in the “Project Report of Mahadayi Hydro Electric Power Project” – Annexure 70

of the Statement of Claims of the State of Karnataka [Volume 54(a)] and thereafter only, utilization of 8.01 tmc of water for in-basin development of Mahadayi Hydro Electric Power Project at Kotni, would be permissible.

1160.

Since water would be released in the downstream of the proposed Kotni dam after hydropower generation, there should not be any issue related to environmental impact. However, it is considered necessary that proper regulation schedule for the project is prepared and the same is strictly adhered to by the project authorities.

1161.

In view of the facts emerging from foregoing paras, the Tribunal is of the view that the State of Karnataka will have to modify the Detailed Project Report (DPR) for the proposed Mahadayi Hydro Electric Power (MHEP) Project for: (a) consumptive use of 1.5 tmc of water within the basin for drinking water, irrigation, etc.; and (b) non-consumptive use for hydropower generation within the basin after duly accounting

for the reservoir losses etc. For the purpose of planning of Mahadayi Hydro Electric Power (MHEP) project, the total available water at 75% dependability at the proposed project site

will be taken as 8.02 tmc i.e., the water availability at 75% dependability assessed by the Tribunal (from catchment area of 93.19 sq.km. i.e., without the Bhandura catchment of 32.25 sq.km.) only.

1162.

It is hereby directed, in clear terms that such utilizations would be permissible only after thorough review and modification of the detailed project reports and that the proposals in the form of detailed project reports would be considered for implementation only: (a) after technical appraisal of the proposed projects by the central agencies; and (b) after obtaining all mandatory clearances as required by law. Till such exercises are completed, no amount of water shall be actually utilized at all by the State of Karnataka, for the proposed Mahadayi Hydro Electric Power Project at Kotni.

Diversion of 7 tmc of surplus water available in Mahadayi basin at the proposed Kotni dam site at 75% dependability

1163.

As per the information provided in the “Detailed

Project Report for Diversion of Surplus Water from Foreshore of

Kotni Dam (MHEP) to Malaprabha River" – Annexure 79(A) to the Statement of Claims of the State of Karnataka [Volume 105(a)], the State of Karnataka has proposed diversion of 7 tmc of surplus water from Kotni reservoir of the Mahadayi Hydro Electric Power (MHEP) Project. Out of proposed 7 tmc of surplus water: (a) 3 tmc of water is to be utilised for protective irrigation in DPAP areas of Ramdurga, Saundatti and Bailhongal Taluks in Belgaum district; (b) 2 tmc of water to be utilized for drinking water and irrigation by recharge of ground water by filling Minor Irrigation Tanks in DPAP areas of Ramdurga, Saundatti and Bailhongal Taluks in Belgaum District by lift schemes; and (c) 2 tmc of water is to be utilized for areas in Malaprabha command which are not getting adequate water as originally planned.

1164.

From the details available at paras 4.1, 4.2 and 4.3 at pages 6- 13 of the "Detailed Proje ct Report for Diversion of Surplus Water from Foreshore of Kotni Dam (MHEP) to Malaprabha River" – Annexure 79(A) to the Statement of Claims of the State of Karnataka [Volume 105(a)], it apparent that 7 tmc

of surplus water, after diversion to Malaprabha river, is proposed to be used for following purposes.

a. 0.86 tmc for drinking water needs of three Talukas namely, Ramdurga, Saundatti and Bailhongal in Belgaum District.

b. 3 tmc for protective irrigation in DPAP areas of Ramdurga, Saundatti and Bailhongal Taluks in Belgaum district.

c. 2 tmc for irrigation in the areas duly covered under the existing command of Malaprabha Project.

d. 1.14 tmc for ground water recharge.

1165.

On this matter, a specific Issue i.e., Issue No. 37 has been framed by the Tribunal for determination as under.

“37. Whether the State of Karnataka proves that (a) surplus water is available at Kotni site in 27 out of 30 years, (b) the minimum and maximum available surplus water with respect to 75% dependable yield is 2.421 tmc and 35.084 respectively, (c) the minimum and maximum available surplus water with respect to 50% dependable yield is 8.043 tmc and 35.084 tmc respectively, (d) out of surplus water, 7.00 tmc could be diverted by using carryover capacity of Malaprabha

dam, and that (e) the diversion of this 7.00 tmc of surplus water would moderate the floods in Goa and reduce the wastage to sea during monsoon.”

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1166.

The aforesaid Issue No. 37 has not been examined by any of the witnesses of the State of Karnataka in its entirety. Shri A. K. Bajaj, Expert Witness of the State of Karnataka has referred to the demand of 7 tmc of surplus water under Para 9, pages 14-15 of Annexure-A to his Affidavit filed on 30.12.2016 (Volume 194) while describing the “Water Needs as Claimed by the three co- basin States of Karnataka, Goa and Maharashtra”. Shri S. M. Jamdar, Witness of the State of Karnataka, in his Affidavit dated 10.11.2017 (Volume 206) has only discussed the need of transfer of 7 tmc of water to Malaprabha reservoir from surplus water at Kotni Dam for providing protective irrigation, drinking water needs etc. in mitigating the hardship caused to the inhabitants in drought prone areas in Malaprabha basin. Prof. A. K. Gosain, Expert Witness of the State of Karnataka has only estimated the availability of water at proposed Kotni dam site and the same is given in Table-4, page 15 of his Report of November 2016 (Volume 193). Thus, aspects of availability of surplus water, particularly the quantum of available surplus water at Kotni

reservoir in different years and the reliability of such surplus water, have not been examined by any of the witnesses of the State of Karnataka.

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1167.

Analysis related to quantum of surplus water available in different years at the proposed Kotni dam site is included in Table- 5 at page 82 of the “Annexure -79(A) – Detailed Project Report for Diversion of Surplus Water from Foreshore of Kotni Dam (MHEP) to Malaprabha River, Vol- I General Report” filed by the State of Karnataka on 5.2.2015 [Volume 105(a)]. In this Table, [i.e., Table-5 at page 82 of Volume 105(a)], the water available in different years is given in Col. 2. It is noted that the availability of water shown in Table-5 at page 82 of Volume 105(a) is entirely different from the values of water availability assessed by Prof. A. K. Gosain, Expert Witness of the State of Karnataka and presented by him in Table-4 at page 15 of his Report of November 2016 (Volume 193). The water availability in different years indicated in Table-5 at page 82 of Volume 105(a) is shown in Col. 3 of Table-6 and the water availability in different years indicated in Table-4, page 15 of the Report of November 2016 of Prof. A. K. Gosain (Volume 193) is shown in Col. 4 of Table-6. The average annual water availability as per Table-5 at page 82 of

Volume 105(a) is 28.5 tmc, but the average annual water availability as per Table-4 at page 15 of Volume 193 is only 25.1 tmc.

Table-6: Comparison of the Estimation of Surplus Water at Proposed

Kotni Dam site with Flow Series in Vol. 105(a) and that with Flow

Series in Vol. 193 [in tmc]

Sl. No.	Year	Flow Series at Kotni Site as per Col. 5, Table-5 at Page 82 of Vol. 105(a)	Flow Series at Kotni Site as per Col. 16, Table-4 at Page 15 of Vol. 193	Surplus with respect to Flow Series in Vol. 105(a)		Surplus with respec to Flow Series in Vol. 193	
				Abstraction	Surplus (Col.3 – Col.5)	Abstraction	Surplu (Col.4 – Col.7)
1	2	3	4	5	6	7	8
1	1980	54.443	43.1	19.359	35.084	19.359	23.741
2	1981	30.562	31.4	19.359	11.203	19.359	12.041
3	1982	35.24	36.7	19.359	15.881	19.359	17.341
4	1983	29.893	23.3	19.359	10.534	19.359	3.941

5	1984	34.766	28.9	19.359	15.407	19.359	9.541
6	1985	14.509	22.3	14.509	0	19.359	2.941
7	1986	20.388	20.1	19.359	1.029	19.359	0.741
8	1987	18.379	17.4	18.379	0	17.4	0
9	1988	34.764	28	19.359	15.405	19.359	8.641
10	1989	23.173	23.6	19.359	3.814	19.359	4.241
11	1990	37.309	34.1	19.359	17.95	19.359	14.741
12	1991	27.794	25.6	19.359	8.435	19.359	6.241
13	1992	27.009	25.2	19.359	7.65	19.359	5.841
14	1993	25.986	24.2	19.359	6.627	19.359	4.841
15	1994	40.986	41.5	19.359	21.627	19.359	22.141
16	1995	20.727	17.2	19.359	1.368	17.2	0
17	1996	15.92	16.9	15.92	0	16.9	0

18	1997	30.255	28.3	19.359	10.896	19.359	8.941
19	1998	23.813	20.3	19.359	4.454	19.359	0.941
20	1999	32.341	27.5	19.359	12.982	19.359	8.141
21	2000	26.666	19.3	19.359	7.307	19.3	0
22	2001	20.397	16.2	19.359	1.038	16.2	0
23	2002	19.676	14.9	19.359	0.317	14.9	0
24	2003	21.591	16.2	19.359	2.232	16.2	0
25	2004	22.347	19.6	19.359	2.988	19.359	0.241
26	2005	31.741	27.1	19.359	12.382	19.359	7.741
27	2006	36.618	24.7	19.359	17.259	19.359	5.341
28	2007	39.43	37.1	19.359	20.071	19.359	17.741
29	2008	33.176	23.6	19.359	13.817	19.359	4.241
30	2009	25.228	19.4	19.359	5.869	19.359	0.041
Average		**28.5**	**25.12**	**-**	**-**	**-**	**-**

2428

1168.

As per Issue No. 37, the surplus water is available at Kotni site in 27 out of 30 years. Without going into the accuracy of the available water or the rationality of projected demand of water, it is observed that the Table-5 at page 82 of Volume 105(a) also indicates surplus water in 27 out of 30 years. However, the Tribunal has completed an analysis by using the inflow assessed by Prof. A. K. Gosain, in Table-4 at page 15 of Volume 193 and the results of the same are given in Table-6. From the results in Table-6, the surplus water is found to be available only in 23 out of 30 years.

1169.

As per Issue No. 37, the minimum and maximum available surplus water with respect to 75% dependable flow are 2.421 tmc and 35.084 tmc respectively. As per Table-5 at page 82 of Volume 105(a), the minimum and maximum available surplus water with respect to 75% dependable flow are 0.317 tmc and 35.084 tmc respectively. However, as per the results presented in Table-6, the minimum and maximum available surplus water with

respect to 75% dependable flow are found to be only 0.041 tmc and 23.741 tmc respectively when the flow series estimated by Prof. Gosain is used.

1170.

It is apparent that with the inflow series assessed by Prof. Gosain, the surplus water of 7 tmc is available only in 11 years out of 30 years. Further, in 7 out of 30 years, there is no surplus at all i.e., the surplus is zero. Obviously, the reliability of the facilities proposed to be planned with the surplus water is very much lesser than what has been stated in the Issue No. 37.

1171.

The State of Karnataka has suggested transfer of 7 tmc of surplus water to Malaprabha reservoir. However, from Col. 5 of Table-5 at page 82 of Volume 105(a), it is apparent that the State of Karnataka, in fact, has considered 9.6 tmc of water for diversion to Malaprabha and not 7 tmc as suggested in the Issue No. 37 framed for determination.

1172.

Without going into the accuracy of the available water, assessed by Prof. A. K. Gosain, Expert Witness of the State of Karnataka, indicated in Col. 16 at Table 4 of Volume 193 or the rationality of projected demand of water, the Tribunal observes

that 28.959 tmc of water proposed to be utilized / diverted from Kotni dam is even more than the average annual available water of 25.1 tmc which reflects a case of highly unsustainable planning.

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1173.

A very important aspect, which has not at all been examined by the State of Karnataka, relates to availability of space in the Malaprabha reservoir to store the surplus water from the proposed Kotni reservoir in specific years. On examination of the Working Table for Malaprabha project at pages 141 to 172 of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B), it is noted that out of 33 years i.e., from 1973-74 to 2005-06, the reservoir gets filled up to the full reservoir level (FRL) and water gets spilled over in as many as 16 years. Thus, in these 16 years, there is no space to hold additional quantity of water. When the information about the proposed diversion of surplus water from Kotni reservoir to Malaprabha reservoir as furnished in Table 5 at page 82 of Volume 105(a), is examined with respect to availability of space in Malaprabha reservoir, the Tribunal finds that in 11 years, the diverted surplus water cannot be stored in Malaprabha reservoir for want of adequate space because in these years the inflow from Malaprabha basin itself is large enough and cannot be held

in the reservoir fully and a part of it has to be spilled over. The details of year-wise surplus water from proposed Kotni reservoir and the status of the Malaprabha reservoir are furnished in the

2431

Table-7. In addition to the surplus indicated in the Volume 105(a), the Table -7 also indicates the surplus water assessed on the basis of the flow series developed by Prof. A. K. Gosain, in his Report of November 2016 (Volume 193).

Table-7:

Year-wise Surplus Water Proposed for Diversion to the Malaprabha Reservoir and Status of the Malaprabha Reservoir

Sl. No.	Year	Surplus with respect to Flow Series in Vol. 105(a) in tmc [From Col. 6 of Table 6]	Surplus with respect to Flow Series in Vol. 193 in tmc [From Col. 8 of Table 6]	Status of Malaprabha Reservoir
1	2	3	4	5
1	1980	35.084	23.741	Reservoir Full
2	1981	11.203	12.041	Reservoir Full
3	1982	15.881	17.341	Reservoir Full
4	1983	10.534	3.941	Reservoir Full

5	1984	15.407	9.541	Reservoir Full
6	1985	0	2.941	
7	1986	1.029	0.741	
8	1987	0	0	
9	1988	15.405	8.641	
10	1989	3.814	4.241	
11	1990	17.95	14.741	
12	1991	8.435	6.241	Reservoir Full

13	1992	7.65	5.841	Reservoir Full
14	1993	6.627	4.841	Reservoir Full
15	1994	21.627	22.141	Reservoir Full
16	1995	1.368	0	
17	1996	0	0	
18	1997	10.896	8.941	Reservoir Full
19	1998	4.454	0.941	
20	1999	12.982	8.141	Reservoir Full
21	2000	7.307	0	
22	2001	1.038	0	
23	2002	0.317	0	

24	2003	2.232	0	
25	2004	2.988	0.241	
26	2005	12.382	7.741	

1174.

From above Table, it is observed that out 26 years, the Malaprabha reservoir gets filled up in 11 years up to full reservoir level (FRL) and hence in these years, there is no scope of storing water by diversion from outside basin, in this case from Mahadayi basin. It is also apparent from the above Table, that some water could be diverted in 8 out of 26 years if the flow series derived by Prof. A. K. Gosain is considered. However, the proposed quantity of 7 tmc is available only in 3 out of 26 years. Obviously, the planning of schemes where objective can be met

2433

only in 3 out of 26 years is meaningless. It is apparent that the State of Karnataka has not prepared the Reports after considering all aspects and hence such Reports cannot be relied upon.

1175.

The Tribunal is of the staunch view that schemes for drinking water supply must be planned from highly reliable sources, which have availability of water at 100% dependability. In this regard, a question was asked to Shri S. M. Jamdar, witness of the State of Karnataka. Question No. 2 put to Shri Jamdar on 29.11.2017 and the reply thereto are reproduced hereunder.

“Q.No.2. At Para 11, page 12 of your Affidavit dated 9.11.2017 (Vol. 206), you have stated as under:

“The plea of the State of Karnataka for transfer of 7 tmc of water to Malaprabha reservoir from surplus water at Kotni Dam for providing protective irrigation, drinking water needs etc. (as mentioned in the amended Statement of Claims dated 15.04.2015, page 122) will go a long way in mitigating the hardship caused to the

inhabitants in drought prone areas in Malaprabha basin.”

In this regard, please answer the following:

a. We understand that drinking water supply must be planned from highly reliable sources, which have

availability of water at 100% dependability. How can the 100% dependability be ensured through the surplus water at Kotni dam which would generally be available only in those years when actual rainfall is more than the average rainfall?

b. Surplus water cannot be considered to be available in each year and particularly during the drought years when there would be no surplus, at all. Therefore, it may not be appropriate to assume that the plan to transfer such surplus water will help in mitigating hardship to the inhabitants during drought periods. As a matter of fact, such measures would only create false hopes. Have you examined all these aspects carefully? How such measures would help providing protective irrigation in mitigating the hardship of the inhabitants of drought prone areas during the drought period?

Ans. I wish to answer the question in two parts:

a. I am to state that the diversion of Kotni Dam water was not intended for drinking water supply. It was basically for power generation and protective irrigation in the drought prone areas. The word appearing in my Affidavit ‘drinking water’ is a mistake and I apologize for the same.

b. On question b I would say that during drought years, definitely there may be deficiency in the flow at Kotni Dam and consequently, deficiency in the quantity of water to be diverted for protective irrigation in the Malaprabha project. But that kind of risk has to be taken at least in the years

2435

whatever quantity of water is available will be

useful.”

[Emphasis supplied]

1176.

In this regard, it is also noted by the Tribunal that at

Para 1.3, page 40 of the “Modified Detailed Project Report of

Malaprabha Project 2009”, which is Annexure -4 to the Reply on

behalf of the State of Karnataka to the Statement of Case filed by

the State of Goa (Volume 33B), the following has been stated.

“The modified project was approved by the Government

of Karnataka for Rs 162.09 Crores vide GO No. PWD 59

GMP 77 dated 04-02-1980.

For drinking water for Hubli-Dharwad, Saundatti and

Bailhongal water utilization is 1.08 TMC. And average

evaporation losses (as observed) is 2.55 TMC.”

1177.

In view of the specific reply of Shri Jamdar that ‘the

for drinking

diversion of Kotni Dam water was not intended

water supply’ and that ‘it was basically for power generation and protective irrigation in the drought prone areas’ and the information about specific allocations for drinking water for Saundatti and Bailhongal, the proposal for drinking water is not found as appealing at all and is hereby rejected.

2436

1178.

Regarding the use of 3 tmc for protective irrigation in DPAP areas of Ramdurga, Saundatti and Bailhongal Taluks in Belgaum district, is found that these aspects are also covered in Para 1.3 and Para 1.4, pages 39-41 of the “Modified Detailed Project Report of Malaprabha Project” – Annexure-4 to the Reply on behalf of the State of Karnataka to the Statement of Case filed by the State of Goa (Volume 33B). The relevant paras of the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B) are reproduced hereunder.

“1.3 Present Proposal

…

The Badami taluka of Bagalkot District, Ramdurga and Saundatti talukas of Belguam Dist., Navalgund of Dharwad, Naragund, Ron talukas of Gadag District are chronically know draught prone areas. The command is of fertile land with B.C. soil and some part of red soil which is also fertile for growing Ground nut, Jowar etc. The command area lies in the range of 600 meter. These

areas are suitable for growing crops like Jawar, Ground nut, Maize and Sunflower. The crops proposed in the project are ·in conformity with agricultural practice, soil condition, suitability and availability of water."

"1.4 Details of canal system

The Malaprabha Canal system mainly comprises two main canals one on either bank of the river along with branches and net work of distribution system consisting

of distributaries minors, water courses and ultimately field channels for carrying water to the last Sub-Division of the last survey number, and the distribution system for the 10 lift irrigation schemes. The canal situated on the right bank is called the Malaprabha Right Bank Canal and commonly referred to as "Malaprabha Right Bank Canal" and the one of the left bank as the Malaprabha Left Bank Canal termed as "Malaprabha Left Bank Canal. In the present proposal construction of the Right Bank Canal for irrigating a total area 121392 Hacters in the districts of Belgaum, Dharwad and Bagalkot. The Malaprabha Right Bank Canal is 142 kilometer in length and had three branches namely (1) Nargund Branch Canal (2) Alur Branch Canal (3) Ron Branch canal. The area to be irrigated was spread over in the following eight talukas: (i) Ramdurga and (ii)Saundatti (Belgaum District) (iii) Badami (Bagalkot District) (iv) Navalgund and (v) Hubli (Dharwad District) (vi)Nargund (vii) Ron and (viii) Gadag (Gadag District).”

From above, it is apparent that necessary provisions have already been made for irrigation for these areas in the of the “Modified Detailed Project Report of Malaprabha Project” of the year 2009, which is Annexure-4 to the Reply on behalf of the State of Karnataka to the Statement of Case filed by the State of Goa (Volume 33B). Therefore, the need to use additional 3 tmc for protective irrigation in DPAP areas is found to be superfluous and cannot be accepted and is hereby rejected by the Tribunal.

2438

1179.

The State of Karnataka has proposed for diversion of 2 tmc for irrigation in the areas duly covered under the existing command of Malaprabha Project. The related information provided in the “Detailed Project Report for Diversion of Surplus Water from Foreshore of Kotni Dam (MHEP) to Malaprabha River” – Annexure 79(A) to the Statement of Claims of the State of Karnataka [Volume 105(a)] is as under.

“4.3 Utilization of 2 TMC of water for providing irrigation to suffering tail end atchkat of MLBC and MRBC command area

Malaprabha Reservoir was constructed for utilization of 44.00 TMC of water. But after studying the reduction in yield to the reservoir over several years, Central Water Commission has accorded approval for the reduction in yield and permitted to utilize only 27.00 TMC of water. Out of this total allocation, 24.234 TMC of water is to be utilized for irrigating 1,96,132 Ha of command area. Even after remodeling of canal system, the tail end

areas are not getting sufficient water for irrigating the approved crops. As a result, the farmers are facing acute hardship in obtaining good yield from crops which has resulted in tail end farmers becoming economically weak and their unrest is expressed in the form of agitation, dharnas and sathyagrahas.

2439

It is observed that about 17,110 Ha of tail end command area of Malaprabha Project is not getting sufficient water for irrigation. The tail end suffering atchkat in Malaprabha Left Bank Canal is about 7,170 Ha and in Malaprabha Right Bank Canal is about 10,000 Ha. For catering to the needs of the suffering atchkat as per the present crop water requirement, the quantum of water required would be about 2.00 TMC.

Hence, it is proposed to provide additional 2.00 TMC of water to the Malaprabha Command area from the present existing canal and distribution network. …"

1180.

It is observed by the Tribunal that the Detailed Project Report of Malaprabha project was revised in the year 2009 and also duly approved on 9.10.2009. The State of Karnataka has not indicated the reasons for non-availability of water to the tail-ender farmers and the initiatives taken by the Government to address the issues. In general, the non-availability of water to the tail-end users result from poor management of the canal system.

None of these aspects are explained by the State of Karnataka. Therefore, such a claim cannot be considered as well founded one and is hereby rejected by the Tribunal.

1181.

The diversion of 1.14 tmc of water to Malaprabha river has been proposed to be used for recharging of ground

water through the existing minor irrigation tanks by filling them twice in a year through proposed lift schemes at various suitable locations on the banks of Malaprabha River in Ramadurga, Saundatti and Bailhongal DPAP Taluks. As already indicated in Para 1178 above, the irrigation for Ramadurga and Saudatti Taluks etc. are duly covered under the “Modified Detailed Project Report of Malaprabha Project” (Volume 33B) and therefore this claim also deserves rejection and is hereby rejected by the Tribunal.

1182.

It is also pertinent to note that the quantum of water indicated in the “Project Report of Mahadayi Hydro Electric Power Project” – Annexure 70 of the Statement of Claims of the State of Karnataka [Volume 54(a)] i.e., 14.564 tmc has been found to be on very higher side and the Tribunal has assessed the water availability at 75% dependability as 8.01 tmc only. Obviously, the quantum of surplus water would come down drastically.

1183.

At Para 3.7 (D), page 53 of the “Written Submissions on behalf of the State of Karnataka” (Volume 220), the learned Counsel for State of Karnataka has stated as under.

2441

“The State of Karnataka proposed to divert 7 tmc of surplus water of Mahadayi to the Malaprabha basin from Kotni reservoir. The surplus water of 7 tmc is actually water in excess or surplus to the 75% dependable flows at Kotni. The State of Goa cannot have any grievance against the utilisation of surplus water by Karnataka in its territory, because its plea is for division of 75% flow. It has not planned any project out of the surplus flow. Therefore, this Hon’ble Court may hold that by diversion of 7 tmc of surplus water by Karnataka from foreshore of Kotni, the State of Goa would not be affected prejudicially.”

1184.

In this regard, it is noted that the State of Karnataka has also pleaded for assessment of water at 75% dependability only, as is apparent from the Issue No. 33, which has been framed for determination by the Tribunal as requested by the State of Karnataka. The Issue No. 33 is reproduced hereunder.

“33. Whether the State of Karnataka proves that the

water availability assessment of the inter-State river Mahadayi should be for 75% dependable flow?”

Allocation of any quantum of water, over and above the water available at 75% dependability at Kotni dam site (in this case, allocation of water of 7 tmc stated to be in excess or surplus to

the 75% dependable flows at Kotni dam site) to the State of Karnataka would not, at all, be justified, if the allocation of water share among the party States is restricted to the availability of water at 75% dependability.

1185.

Further, the water which overflows from the reservoir during the monsoon period plays very important role in maintaining the river regime in the lower reaches of the river and is also necessary from environmental point of view. In this regard, Para 3.3 of the National Water Policy 2012 states as under.

“ 3.3Ecological needs of the river should be determined, through scientific study, recognizing that the natural river flows are characterized by low or no flows, small floods (freshets), large floods, etc., and should accommodate developmental needs. A portion of river flows should be kept aside to meet ecological needs ensuring that the low and high flow releases are proportional to the natural flow regime ,including base

flow contribution in the low flow season through regulated ground water use."

[Emphasis supplied]

2443

1186.

In view of above, the Tribunal is of the opinion that the demand of the State of Karnataka in respect of proposed diversion of 7 tmc of surplus water from Kotni reservoir of the Mahadayi Hydro Electric Power (MHEP) Project cannot be accepted and is hereby rejected by the Tribunal.

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

VOLUME - XII

(V O L U M E S I - XII)

New Delhi

14 th August 2018

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

I N D E X

VOLUME – I

Sl. No.

1.

D E S C R I P T I O N

Introduction and Constitution of Tribunal

Order dated 16.10.2012 passed by the Tribunal in I.A. No.2 of 2012 filed by the State of Goa whereby directions were given to the three States to file their respective Statements of Claims alongwith Replies and Rejoinders

Chronological details of the Statement of cases/claims filed by the States of Goa, Maharashtra and Karnataka, along with Replies and Rejoinders.

Issues originally framed by the Tribunal vide Order dated 21.8.2013.

Visit of the Tribunal to different sites

and the Report dated 12.02.2014 of the

Assessors on the visits of the Tribunal.

PAGE NOS

1-6

2.

6-7

3.

7- 9

4.

9 - 18

5.

19 - 46

6.

Order dated 04.03.2014 passed by the Tribunal in I.A. No. 19 of 2014 filed by the State of Goa for Amendment of Statement of claims and the consequential Pleadings of the Party States.

Order dated 01.04.2014 passed in I.A. No. 21 of 2014 filed by the State of Maharashtra for Amendment of Statement of Claims and consequential Pleadings of the Party States

Order dated 17.04.2014 passed in I.A. No. 1 of 2012 filed by the State of Goa for restraining the State of Karnataka not to actually utilize or divert the water under the Kalasa-Bhandura Project.

Order dated 03.09.2014 passed by the Tribunal pointing out inconsistencies

and discrepancies in the Pleadings of the Party States.

Order dated 15.04.2015 passed by the Tribunal in I.A. No. 29 of 2014 permitting the State of Karnataka to withdraw its application for Amendment of its Statement of Claims.

46 - 47

7.

47 - 48

8.

49 - 52

9.

52 - 79

10.

79 - 80

11.

Details of further Amendments of their respective Statement of cases/claims by the three Party States as well as the Replies and Rejoinders thereto.

Order dated 06.05.2015 passed by the Tribunal in I.A. No. 28 of 2014 filed by the State of Goa directing the State of Maharashtra not to undertake, commence the work of gorge portion of Virdi Dam.

Prayers of the State of Goa

Prayers of the State of Karnataka

Prayers of the State of Maharashtra

<u>VOLUME – II</u>

80 - 83

12.

84 - 86

13.

14.

15.

86 - 92

92 - 95

95 - 99

16.

Pleadings of the State of Goa

100 - 341

VOLUME – III

17.

18.

19.

Pleadings of the State of Karnataka

Pleadings of the State of Maharashtra

Re-framing/Re-casting of Issues vide

Order dated 17.07.2015.

342 - 487

488 - 525

525 - 543

20.

Order dated 27.07.2016 passed by the Tribunal in IAs. No. 60 of 2015 & 66 of 2016 filed by the State of Karnataka rejecting its prayer to permit it to divert 7 tmc of water.

544 - 586

VOLUME – IV

21.

Details of oral evidence led by the Party States

- **Oralevidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Oralevidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Oralevidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**

VOLUME – V

Details of oral evidence led by the Party States contd…

Oralevidence of MW-1 Shri S.N.

Huddar for the State of

Maharashtra

Oralevidence of AW-2 Shri Paresh

Porob for the State of Goa

804 - 836

587 - 593

593 - 698

699 - 756

757 - 803

836 - 856

Oralevidence of AW-3 Dr. Shamila Monteiro for the State of Goa

Oralevidence of AW-4 Shri Rajendra P. Kerkar for the State of Goa

Oralevidence of AW-5 Shri Subrai T. Nadkarni for the State of Goa

Oralevidence of RW-3 Shri S.M. Jamdar for the State of Karnataka

Oralevidence of RW-4 Shri G.M. Madegowda for the State of Karnataka

Oralevidence of MW-2 Shri B.C. Kunjir for the State of Maharashtra

856 - 865

865 - 877

877 - 913

914 - 929

929 - 945

946 - 954

22.

Evaluation of the oral evidence led by the three Party States

Findingson conflicting results arrived at by the Experts relating to water availability

Principlesgoverning appreciation of the oral evidence given by the witnesses on Hydrology

954 - 955

955 - 966

966 - 970

- **Evaluationof oral evidence of AW-1 Shri Chetan Pandit for the State of Goa**
- **Evaluationof oral evidence of RW-1 Prof. A.K. Gosain for the State of Karnataka**
- **Evaluationof oral evidence of RW-2 Shri A.K. Bajaj for the State of Karnataka**
- **Evaluationof oral evidence of MW-1 Shri S.N. Huddar for the State of Maharashtra**
- **Evaluationof oral evidence of AW-2 Shri Paresh Porob for the State of Goa**

<u>VOLUME – VI</u>

Evaluation of the oral evidence led by the three Party States contd…

- **Evaluationof oral evidence of AW-3 Dr. Shamila Monteiro for the**

State of Goa

Evaluationof oral evidence of AW-

4 Shri Rajendra P. Kerkar for the

State of Goa

971 - 984

984 - 1016

1017 - 1030

1030 - 1039

1040 - 1052

1053 - 1058

1058 - 1066

🎬 Evaluationof oral evidence of AW-

5 Shri Subrai T. Nadkarni for the

State of Goa

🎬 Evaluationof oral evidence of RW-

3 Shri S.M. Jamdar for the State of

Karnataka

🎬 Evaluationof oral evidence of RW-

4 Shri G.M. Madegowda for the

State of Karnataka

🎬 Evaluationof oral evidence of

MW-2 Shri B.C. Kunjir for the State

of Maharashtra

1066 - 1085

1085 - 1093

1093 - 1103

1103 - 1110

23.

Decision and findings by the Tribunal on

important questions.

🎬 Prejudice

- **Effectof deletion of paras 28 (iv) and 28 (v) from Goa's complaint dated 09.07.2002.**
- **Findingson whether the Central Water Commission Report of March, 2003 is to be treated as Report of the Central Water Commission.**

1110 - 1132

1132 - 1201

1201 - 1224

- **Determinationof Dependability at which water availability is to be assessed.**
- **Decisionrelating to mandatory requirements for project implementation.**

<u>VOLUME –VII</u>

Decision and findings by the Tribunal on important questions contd…

- **Hydrologyand Water Availability**
- **MonthlyRainfall Data for the period from June, 1901 to May, 2013**

<u>VOLUME – VIII</u>

Decision and findings by the Tribunal on important questions contd…

- **DailyRainfall Data for the period from June, 1901 to May, 1940**

1225 - 1248

1249 - 1290

1291 - 1443

1444 - 1500

1501 - 1735

VOLUME – IX

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1940 to May, 1976

1736 - 1952

VOLUME – X

Decision and findings by the Tribunal on

important questions contd…

- **DailyRainfall Data for the period**

from June, 1976 to May, 2013

1953 - 2175

VOLUME – XI

Decision and findings by the Tribunal on

important questions contd…

- **Ecology**
- **Navigation**

2176 - 2244

2245 - 2276

24.

Determination of water requirements

of the three Party States

Stateof Karnataka

2277 - 2443

VOLUME – XII

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2444 - 2481

2481 - 2545

25.

Decision on issues framed for

determination

- **IssuesRelated to Data Availability**

and Quality of Data

- **IssuesRelated to Hydrological**

Analysis and Methodology for

Assessment of Water Availability

- **IssuesRelated to Dependability**

for Assessment of Water

Availability

- **IssuesRelated to Water Utilization**

for various Purposes, Projected

Demand of Water by the

Respective States, and their

Allocations

2546

2546

2547

2547 - 2548

- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the Basin**
- **IssuesRelated to Adverse Impact of the Proposed Projects of the**

State of Karnataka on Projects of

State of Maharashtra

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

26.

Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **CauveryWater Committee**

Regulatory

2559 - 2562

2562 - 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

Establishmentof Cauvery Water Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

River

–

2612 - 2615

2615 - 2619

- **KrishnaWaters Decision**

Implementation Board

- **BhakraBeas Management Board**

- **VansadharaSupervisory**

Committee

2619 - 2621

2621 - 2625

- **Hon’bleSupreme Court Judgment**

on Babhali Barrage Project

reported in 1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of

Water Resources of Mahadayi

Basin

Constitutionof the Authority

27.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

Recommendations

DataObservation and Data Bank

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

28.

29.

2667 - 2672

2672 - 2679

- **Guidelinesfor Hydrological Analysis for Assessment of Water Availability and Training for Professionals**
- **Suggestionsfor Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956**
- **Participationof Union Government in the proceedings of the Tribunals**

2679 - 2686

2686 - 2691

2691 - 2693

30.

31.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

REPORT OF THE MAHADAYI WATER DISPUTES TRIBUNAL

S H O R T

I N D E X

VOLUME – XII

Sl. No.

1.

D E S C R I P T I O N

Determination of water

requirements of the three Party States

contd…

- **Stateof Maharashtra**
- **Stateof Goa**

2.

Decision on

determination

issues

framed

for

2444 - 2481

2481 - 2545

PAGE NOS

- **IssuesRelated to Data Availability and Quality of Data** **2546**
- **IssuesRelated to Hydrological Analysis and Methodology for Assessment of Water Availability** **2546**
- **IssuesRelated to Dependability for Assessment of Water Availability** **2547**

- **IssuesRelated to Water Utilization for various Purposes, Projected Demand of Water by the Respective States, and their Allocations**
- **IssuesRelated to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.**
- **IssuesRelated to Navigation**
- **IssuesRelated to Effect to Deletion of Para 28(iv) and 28 (v) from Pleadings of the State of Goa**
- **IssuesRelated to Need for Prior Consent of Co-basin States for Undertaking Projects/ including Projects for Diversion outside Mahadayi Basin**
- **IssuesRelated to Sharing of the Water and Benefits out of the Water Allocated of Utilization Outside the**

Basin

IssuesRelated to Adverse Impact of the Proposed Projects of the State of Karnataka on Projects of State of Maharashtra

2547 - 2548

2548

2548

2549

2549 - 2550

2550 - 2556

2556 - 2558

- **IssuesRelated to Over-the Year Storage/Carry Over Storage by the Upper Riparian State**
- **IssuesRelated to Project-wise Restrictions on Storages etc.**

3. Need for Authority/Board for integrated planning and management of Water Resources of Mahadayi Basin

- **Issuesframed for Determination**
- **ModifiedInter-State River Water Disputes Act, 1956**
- **Recommendationsmade by Shri Chetan Pandit**
- **NarmadaControl Authority**
- **CauveryRiver Authority (CRA)**
- **CauveryManagement Board**
- **Cauvery Committee**

Water

Regulatory

2559 - 2562

2562 – 2567

2568 - 2578

2579 - 2582

2582 - 2585

2585 - 2590

2590 - 2592

2593 - 2596

2596 - 2598

🎬 Establishmentof Cauvery Water

Management Authority

2598 - 2612

- **Godavariand Krishna**

Management Board

- **KrishnaWaters Decision**

Implementation Board

River

2612 - 2615

–

2615 - 2619

- **BhakraBeas Management Board**
- **VansadharaSupervisory Committee**
- **Hon’bleSupreme Court Judgment on**

Babhali Barrage Project reported in

1988 (7) SCC, P-303

- **ImportantActivities Essentially**

Required to be Undertaken for

Sustainable Development of Water

Resources of Mahadayi Basin

- **Constitutionof the Authority**

4.

Equitable apportionment of Waters of

Mahadayi River

Water Sharing Mechanism

2619 - 2621

2621 - 2625

2625 - 2628

2629 - 2631

2631 - 2640

2641 - 2666

5.

2667 - 2672

6.

Recommendations

- **DataObservation and Data Bank**
- **Guidelinesfor Hydrological Analysis**

2672 - 2679

2679 - 2686

for Assessment of Water Availability

and Training for Professional

Suggestionsfor Reviewing the

Provisions of the Inter-State River

Water Disputes Act, 1956

Participationof Union Government in

2686 - 2691

2691 - 2693

the proceedings of the Tribunals

7.

8.

Award and Final Decision of the Tribunal

Acknowledgment

2693 - 2706

2706 - 2711

2444

DETERMINATION OF WATER REQUIREMENTS OF THE THREE PARTY-STATES CONTD.. …..

STATE OF MAHARASHTRA

1187.

The Government of Maharashtra, in its “Letter of Complaint under Section 3 of the Inter State River Water Disputes Act, 1956, Read with Inter-State Water Disputes Rules 1959” vide letter No. Mandvi -2010/CR-247/WRP dated 13.10.2010 addressed to the Secretary to the Government of India, Ministry of Water Resources (pages 41-47, Volume 1), has not indicated any specific quantum of water of Mahadayi river basin as the demand of the State of Maharashtra. However, various paras which directly or indirectly refer to the issue of the demand of water or equitable apportionment of the water of

Mahadayi river basin, in the above mentioned letter of complaint of the State of Maharashtra are reproduced hereunder.

Para 3(I)(b), page 43, Volume 1

“(b) What would be the share of each State on equitable apportionment of water of the Inter State River Mandovi?”

Para 3(II), page 45, Volume 1

“II) Subject to the leave of the Tribunal the State of Maharashtra reserves it’s right as under: -

a. To file statement of case.

b. To submit additional schemes in the form of projects to benefit it’s habitant.

c. To oppose or contest the claims of State of Karnataka and Goa.

d. To file the Master Plan for utilization of Mandovi River Basin Water in Maharashtra.

e. To file correspondence, minutes of the meeting, documents, maps studied, project reports, any other technical material or data besides leading oral evidence in support of it’s case.”

Para 5(a), page 46, Volume 1

“(a) Maharashtra State having an equitable share in the water of Mandovi River has proposed Virdi Project and several other projects within it’s territory. The State of Goa in the C.M’s meeting of the two States on 26/4/2006, permitted the State of Maharashtra to

construct Virdi project."

1188.

Through the "Further Amended Statement of Case of the State of Maharashtra" filed on 20.4.2015 (Volume 127), the State of Maharashtra has sought following reliefs in respect of the water demand and equitable apportionment of waters of the inter-State river Mahadayi and its valley:

"Water needs of Maharashtra from Mandovi river basin.

2446

3.5.1 Theagricultural needs of Maharashtra have been assessed vide para 3.1.9 as 132.27 M.Cum

3.5.2 Asenumerated in the forgoing paras the water needs for agriculture, drinking and industrial area in part of Mandovi river and adjoining part of Tilari basin have been determined and the break up of the proposed utilization is given hereunder:

1) Irrigation needs of
Maharashtra

2) Drinking water needs in part
of Mandovi river basin

3) Drinking water needs in
adjoining uncommanded area
of Tilari basin

4) Industrial water needs in part
of Mandovi river basin

5) Industrial water needs in
adjoining uncommanded area
of Tilari basin

6) Provision for future

development

7) Evaporation losses 10 %

Grand Total

Say

-

-

-

132.27 Mm 3

1.65 Mm 3

2.00 Mm 3

-

-

1.00 Mm 3

1.10 Mm 3

-

-

-

-

25.00 Mm 3

16.30 Mm 3

179.32 Mm 3

180.00 Mm 3 ”

2447

1189.

In view of the information included in the Statement of Claims of the State of Maharashtra and related documents, following Issues related to demand of waters of Mahadayi river basin by the State of Karnataka for various purposes, were finally framed for d etermination vide Tribunal's Order dated 17.7.2015.

"57. Whether the State of Maharashtra proves that it is entitled to allocation of 180.00 mcm water from total yield of river Mahadayi?

58. Whether the State of Maharashtra proves that it is entitled to divert the water of river Mahadayi outside the basin for meeting projected requirements in Tilari basin?"

Present Utilization of Water of Mahadayi River Basin by the State of Maharashtra

1190.

The State of Maharashtra has not reported any scheme or project through which the waters of Mahadayi river basin is being presently utilized in the State of Maharashtra.

Therefore, the existing utilization of waters of Mahadayi river basin by the State of Karnataka is considered as negligible.

2448

Projected Demand of Water of Mahadayi River Basin by the State of Maharashtra for various Purposes

1191.

The Tribunal observes that the State of Maharashtra had earlier filed the “Master Plan of Mahadayi Basin” as Annexure – 20 to the Statement of Case of the State of Maharashtra (Volume 52D) on 17.10.2013. The projected demand of water for various purposes as mentioned at Para 6.5, page 3 of the Master Plan of Mahadayi basin (Volume 52D) are as under.

“…

Thus to utilize 177 M. Cum (6.25 TMC) of available water in the basin the Master Plan of Mahadayi Basin is prepared.

1.

2.

3.

4.

5.

For Irrigation (In basin for

4600 Hect)

Drinking purpose (In basin)

Hydro Power Generation

For Industrial

For Irrigation in Tilari Basin

Total

:

:

:

:

:

:

55.00 M. Cum

5.00.M. Cum

15.00 M. Cum

25.00 M. Cum

80.00 M. Cum

180.00 M. Cum”

1192.

Subsequently,

the

Witness

of

the

State

of

Maharashtra, Shri B. C. Kunjir filed “A Study in respect of Water

Needs of Maharashtra in Mahadayi Basin" as Annexure -2 to his Affidavit dated 27.10.2017 (Exh. MAH/MW-2/1), wherein the projected needs in respect of the water of Mahadayi river basin for various purposes are indicated at page 27 as under.

"Thus, the total needs of Mahadayi basin along with nearby Tillari valley villages is summarized in the following table:

figures in Mcum

Sr. No.	Particulars	As per Study		
		In Basin (Mahadayi)	Outside Basin (Tillari)	Total
1	Irrigation use	80.00	65.00	145.00
2	Drinking	2.00	3.00	5.00
3	Industrial	9.00	3.00	12.00
4	Evaporation losses	9.00	9.00	18.00

5	Hydro Power Generation (Non-consumptive)	0.00	0.00	0.00
	Total	100.00	80.00	180.00”

1193.

The State of Maharashtra has projected future demand of water of Mahadayi river basin in the State of Maharashtra as 180 Mcum for various purposes, i.e., for irrigation, drinking water, industrial uses, hydropower generation within the Mahadayi river basin as well as outside the Mahadayi

river basin i.e., in Tillari basin. However, it is found that there are variations in the projected quantum of water use for various purposes indicated in different documents filed by the State of Maharashtra. The variations are illustrated in Table-1.

Table-1: Projected Quantum of Water Use (in Mcum) for Various Purposes by the State of Maharashtra in respect of Water of Mahadayi River Basin

Sl. No.	Purpose	As per Master Plan (Vol.52D)	As per Statement of Case (Vol.127)	As per Study by Shri Kunjir, the Witness of State of Maharashtra (Vol.205)
1	Irrigation a. Within basin b. Outside basin Sub-total	55 80 135	132.27	80 65 145
2	Drinking water a. Within basin b. Outside basin Sub-total	5 - 5	1.65 2.00 3.65	2 3 5
3	Industrial uses a. Within basin b.	25 - 25	1.00 1.10	9 3 12

	Outside basin Sub-total		2.10	
4	Hydro-power development	15	-	-
5	Evaporation losses	-	16.30	18
6	Future development	-	25.00	-
	Total	180	179.32 Say, 180	180

2451

1194.

From the above, it is apparent that there are considerable variations in the projected quantum of water of Mahadayi river basin for use by the State of Maharashtra for various purposes. It is noticed by the Tribunal that the variations mentioned above have not been explained by the State of Maharashtra in any of the documents filed by it. It is also noted that at Para 2.1, page 4 of his Affidavit dated 27.10.2017, Shri B. C. Kunjir, the Witness of the State of Maharashtra, it is mentioned about the projected future needs of the State of Maharashtra in respect of water of Mahadayi river basin as included in the “Master Plan of Mahadayi Basin” (Volume 52D) and as mentioned in the “Further Amended Statement of Case of the State of Maharashtra” (Volume 127). Subsequently at Para 3.5, page 8 of his Affidavit dated 27.10.2017, Shri Kunjir mentioned about his assessment of projected future needs of the State of Maharashtra in respect of water of Mahadayi river basin, which is quite different than that included either in the “Master Plan of Mahadayi Basin” (Volume 52D) or as mentioned in the

“Further Amended Statement of Case of the State of Maharashtra” (Volume 127). However, Shri Kunjir has also not explained the reasons for variations.

2452

1195.

In this regard, Shri B. C. Kunjir, Witness of the State of Maharashtra was asked question No. 2 on 1.12.2017 by the Tribunal. The question and the answer thereof are reproduced hereunder.

“Q.No.2. Table under Para 3.5 at page 8 of your Affidavit dated 27.10.2017 (Vol. 205), provides the water demand of State of Maharashtra in Mahadayi basin for various purposes. We find that in many cases, the demands of water as per your study are different from the one indicated by the State of Maharashtra at Para 3.5.2, Pages 23- 24 of the “Further Amended St atement of Case of the State of Maharashtra” (Vol.127) and also reported at Para 2.1, page 4 of your Affidavit. The variations are summarized hereunder.

a. Your study indicates water needs for irrigation as 145.00 Mcum against 132.27 Mcum mentioned in the Statement of case of Maharashtra.

b. Your study indicates water needs for drinking

purposes as 5.00 Mcum against 3.65 Mcum mentioned in the Statement of case of Maharashtra.

c. Your study indicates water needs for industries as 12.00 Mcum against 2.10 Mcum mentioned in the Statement of case of Maharashtra.

d. Your study indicated evaporation losses as 18.00 Mcum against 16.30 Mcum mentioned in the Statement of case of Maharashtra.

2453

Further, there is provision of 25 Mcum for future development in the Statement of Case of the State of Maharashtra. However, you have not kept any provision for future development.

Please explain the reasons for variations in water demand for different purposes estimated by you and that included in the Further Amended Statement of Case of the State of Maharashtra.

Ans. I have no comments to offer to various parts of the question. ”

[Emphasis supplied]

Thus, it stands established that variations in assessment of projected quantum of water of Mahadayi river, totally remain unexplained and cannot be relied upon by the Tribunal, at all.

1196.

In the above backdrop, it is found that various assessments of projected water demands in respect of water of Mahadayi river basin by the State of Maharashtra are not based on thorough investigation of all related issues including the

surveys etc. of the potential projects sites for utilization of water. This is evident from Para 3.1.7, page 21 of the “Statement of Case of the State of Maharashtra for Mahadayi Water Dispute

2454

Tribunal" (Volume 27) filed on 2.1.2013, wherein following has been stated.

" **3.1.7.** Govt.of Maharashtra vide letter dated 30.9.2011 sought the survey and investigation for additional projects which could be taken in Mandovi Basin for utilisation of its share of waters. (Annexed hereto and marked **Annexure11** isthe copy of the said letter) Accordingly following sites have been identified and survey & investigation for preparing report is in progress. "

[Emphasis supplied]

1197.

It is evident that the State of Maharashtra has made an effort to project the available water at 75% dependability as the utilizable water and hence the future water demand. This is apparent from the statement of the State of Maharashtra in the "Master Plan of Mahadayi Basin" (Volume 52D), which is reproduced hereunder.

"6.5 As per this report the 75 % & 50 % d ependable

yield of Mahadayi basin in Maharashtra is as follows.

(Enclosed as Annexure - IP. No. 5 To 46)

Sr. No.	Yield	Yield Calculations by Inglish formula from 25 Years	Yield Calculations of Halter & Dicholim Nalla

		Data of Virdi Station	from 40 Years Rainfall Data by establishing Rainfall-Rainfall & Rainfall-Runoff co-relation
A.	75% dependable Yield	211.98 M. Cum	**177.208 M. Cum**
B.	50% dependable Yield	243.75 M. Cum	**191.268 M. Cum**

Thus to utilize 177 M. Cum (6.25 TMC) of available water in the basin the Master Plan of Mahadayi Basin is prepared.

1.

2.

3.

4.

5.

For Irrigation (In basin for

4600 Hect)

Drinking purpose (In basin)

Hydro Power Generation

For Industrial

For Irrigation in Tilari Basin

Total

:

:

:

:

:

:

55.00 M. Cum

5.00.M. Cum

15.00 M. Cum

25.00 M. Cum

80.00 M. Cum

180.00 M. Cum"

[Emphasis supplied]

1198.

In view of above, it would not be appropriate at all to

accept the projected future demand of 180 Mcum by the State of Maharashtra in respect of water of Mahadayi river basin, which is almost equal to water availability from the catchment area of

Mahadayi river basin in the territory of the State of Maharashtra at 75% dependability. The assumption of the State of Maharashtra that all the available water at 75% dependability can be considered as utilisable water is not well founded either actually or legally. This becomes evident, at once, if one refers to the information provided by the State of Maharashtra in respect of water availability estimated at 75% dependability and the proposed annual utilization in respect of four identified projects which are indi cated in the “Compilation of Pre -Feasibility Report and Salient Features of Proposed Projects in Mahadayi Basin” [Volume 113(b)]. The related informations are summarized in Table-2, compiled by the Tribunal using the information provided by the State of Maharashtra in Volume 113(b).

Table-2: Projects proposed by the State of Maharashtra

Sl. No.	**Proposed Projects**	**Water availability at 75% dependability (in Mcum)**	**Proposed Annual Utilization (in Mcum)**
1.	Virdi (Morachi Rai) Minor Irrigation	14.78	8.95

	Project		
2.	Virdi B Minor	6.72	4.49

2457

	Irrigation Project		
3.	Dhangarwadi Minor Irrigation Project	9.97	7.86
4.	Ambadgaon Minor Irrigation Project	8.31	0.54

1199.

The Tribunal is, of the firm opinion that the approach for planning the available water resources without going into the realistic demand would lead to non-optimal planning of the available water resources. The National Water Policy 2012 has laid due emphasis on the demand management at para 1.3 (viii), which is reproduced hereunder.

“(viii) Given the limits on enhancing the availability of utilizable water resources and increased variability in supplies due to climate change, meeting the future needs will depend more on demand management, and hence, this needs to be given priority, especially through (a) evolving an agricultural system which economizes on

water use and maximizes value from water, and (b) bringing in maximum efficiency in use of water and avoiding wastages.”

1200.

While addressing the issues related to ADAPTATION TO CLIMATE CHANGE, the need for demand management has,

2458

further, been emphasized in the National Water Policy 2012 at Para 4.3, which is reproduced hereunder.

“4.3 The adapta tion strategies could also include better demand management, particularly, through adoption of compatible agricultural strategies and cropping patterns and improved water application methods, such as land leveling and/or drip / sprinkler irrigation as they enhance the water use efficiency, as also, the capability for dealing with increased variability because of climate change. Similarly, industrial processes should be made more water efficient.”

In view of above conclusions, it is difficult for the Tribunal, to take into consideration and / or to accept the demand for projected quantum of water of Mahadayi river basin made by State of Maharashtra and therefore, the said demand is hereby rejected.

Proposal for Diversion of Water of Mahadayi River Basin to Tillari Basin

1201.

From Table-1 under Para 7, pages 6-7, it is apparent that the State of Maharashtra has proposed to divert considerable quantum of water of Mahadayi river basin to Tillari

ba sin. As per the “Master Plan of Mahadayi Basin” (Volume 52D), the quantum of water of Mahadayi river basin proposed to be diverted to Tillari basin is 80 Mcum (2.82 tmc) out of total projected demand of 180 Mcum (6.35 tmc). However, as per the study included in the Affidavit dated 27.10.2017 of Shri B. C. Kunjir, Witness of the State of Maharashtra (Volume 205), the quantum of water of Mahadayi river basin proposed to be diverted to Tillari basin is 71 Mcum (2.51 tmc) out of total projected demand of 180 Mcum (6.35 tmc).

1202.

In this regard, it is relevant to notice that the existing Tillari Project which was implemented and is being managed jointly by the States of Maharashtra and Goa, provides for diversion of water of Tillari basin to Mahadayi basin. At para 4.6, page 21 of his affidavit dated 15.9.2015 [Volume 163(a)], Shri S. N. Huddar, Witness for the State of Maharashtra has stated that out of the Goa’s share of 459.68 Mcum in the Tillari project, the utilization in Mandovi basin is 261.33 Mcum. The State of Goa has also mentioned at para 2(d), page 3, of the “Affidavit in

Answer Submitted on behalf of State of Goa to the Interrogatories administered by State of Maharashtra on 03/04/2014” (Volume 102) that the total quantum of water from

the Tillari irrigation project used in Mahadayi basin is 261.33 Mcum out of the State of Goa's share of 459.68 Mcum, Thus, the diversion from Tillari basin to Mahadayi basin is 261.33 Mcum i.e. 9.22 tmc. Obviously, therefore, the Tillari basin cannot be considered as water-deficient or water-short basin, at all.

1203.

Further, at Para 5.1, page 11 of his Affidavit dated 27.10.2017 (Volume 205), Shri B. C. Kunjir, Witness of the State of Maharashtra has stated that as per availability per capita and availability per unit land, both basins are abundant. The relevant Para 5.1 is reproduced hereunder.

"5.1 I state that the use in Tillari bas in, though a diversion by definition, is most natural, because the higher level cultivable fields in Tillari basin, can be then irrigated by gravity canals. Secondly, this will at least partially compensate for the diversion already made by State of Goa to Mandovi basin from Tillari basin. (261.33 Mcum by State of Goa – Reference Document Volume No. 102, page 3). As per availability per capita and

availability per unit land both basins are abundant as seen from Maharashtra Water & Irrigation Commission Report, Volume I – APPROACH, June 1999, pages 144 to 146 and page 516 of the said report. These relevant pages are annexed hereto and marked as **Annexure– 3 (Colly)** .It may also be noted that the current level of

consumption in entire Mahadayi basin is abysmally low.”

1204.

In Para 5.1 of his Affidavit, Shri Kunjir has also stated that the diversion of Mahadayi water to Tillari basin “ will at least partially compensate for the diversion already made by State of Goa to Mandovi basin from Tillari basin. (261.33 Mcum by State of Goa – Reference Document Volume No. 102, page 3)”. Apparently, this statement of Shri Kunjir is out of context as the Tillari project was jointly implemented by the State of Maharashtra and the State of Goa and that the agreement for this purpose does not provide for any compensation, whatsoever. This is an obvious attempt made by State of Maharashtra, to back out from the agreement entered into between State of Maharashtra and State of Goa, and such a course cannot be permitted to be adopted by this Tribunal. In this regard, the learned Advocate General of the State of Goa asked the question No. 1 on 1.12.2017 to Shri Kunjir. The question No. 1 and the answer thereof are reproduced

hereunder.

“Q.No.1. Please refer to para 5.1, at page 11 of your Affidavit dated 27.10.2017 (Vol. 205), wherein you have stated as under:

“Secondly, this will at least partially compens ate for the diversion already made by State of Goa to Mandovi basin from Tillari basin. (261.33 Mcum by State of Goa-Reference Document Volume No.102, page3).”

In this regard, I draw your attention to MARK-MAH/3(Colly.), namely, Agreement dated, 06.04.1990, entered by and between the Government of the State of Goa and the Government of the State of Maharashtra. Can you cite or show any clause of this Agreement, which contemplates or provides for compensating the share of water of Tillari basin, given to the State of Goa under the Agreement, to be compensated by any water from Mahadayi basin?

Ans. I would like to answer this question in two parts.

a. I am aware that no such clause exists in the aforesaid Agreement.

b. The word ‘compensation’ refers to any derogatory effects, if any, of transfer of water from Tillari (Chapora basin), caused due to the effect of the above Agreement.”

1205.

Further, Shri Kunjir has stated in Para 5.1 of his Affidavit dated 27.10.2017 (Volume 205) that “ the use in Tillari basin, though a diversion by definition, is most natural, because

the higher level cultivable fields in Tillari basin, can be then irrigated by gravity canals", it is not explained by Shri Kunjir as to why the area of the Tillari basin of the State of Maharashtra which is proposed to be provided irrigation through the Virdi Large MI Project by diverting the water of Mahadayi river basin, was not considered for irrigation at the time of planning and implementation of the Tillari Project itself. Even if case put forth by Shri Kunjir is taken on its face value, the whole process speaks of fragmented approach to planning of water resources without considering all aspects in proper perspective. Such fragmented approach, can never be approved by this Tribunal.

1206.

In view of above, the Tribunal is of the firm opinion that the proposal of the State of Maharashtra for diversion of water of Mahadayi river basin to Tillari basin for irrigation or for industrial uses cannot be accepted and is hereby rejected.

Identification of Projects / Schemes

1207.

The Tribunal finds that while indicating the future

projected needs of water of Mahadayi river basin for various purposes, Shri Kunjir has not made specific mention of the

projects / schemes for utilization of the water of the Mahadayi river basin. The identification of various projects / schemes is considered a bare minimum necessity because, only then, it will be possible to assess the “utilizable water” out of “available water”. However, it is noted that the “Mast er Plan of Mahadayi Basin” of the State of Maharashtra (Volume 52D) has identified the ongoing and the proposed projects in Mahadayi river basin at Para 7.0, page 4. Para 7 of the Volume 52D is reproduced hereunder.

“7.0 ONGOING & **PROPOSEDPROJECTS IN MAHADAYI BASIN (MAHARASHTRA)** :

The on-going & proposed projects in the basin are as below.

(Map enclosed on P. No. 48)

Sr. No.	Projects	On-going project in M.Cum	Proposed storage in M.Cum	Total proposed storage in M.Cum
1.	Virdi M.I.	14.819	13.381 (Addition-	28.20

	Project		al)	
2.	Virdi (Morachi Rai) M.I.P.	-	31.41	31.41
3.	Virdi – ‘B’ M.I.P.	-	8.00	8.00
4.	Virdi – ‘C’	-	3.23	3.23

	M.I.P.			
5.	Talekhol M.I.P.	-	4.50	4.50
6.	Dhangaerwadi M.I.P.	-	7.00	7.00
7.	Vazare M.I.P.	-	3.50	3.50
8.	Ambadgaon M.I.P.	-	3.50	3.50
9.	K.T. Weirs	-	11.00	11.00
	Total Storage Proposed	**14.819**	**85.521**	**100.34**

Note:- Thepreparation of D.P.R. of above projects is in progress."

1208.

The Tribunal finds that except for Virdi Large Minor Irrigation Project, the DPR of none of the proposed projects are finalized by the State of Maharashtra, at all.

1209.

It is worth noticing by the Tribunal that the State of Maharashtra, in its “Statem ent of Case of the State of Maharashtra for Mahadayi Water Dispute Tribunal” (Volume 27) filed on 2.1.2013 has also mentioned about the present and investigated plan at paras 3.1.5 to 3.1.7, pages 20-21. It is, however, noticed that in Volume 27, the name of K.T. Weirs does not appear in the list of ongoing and proposed projects.

2466

1210.

It is further found by the Tribunal that following has been stated at Para 3.2, page 20- 21 of the “Further Amended Statement of Case of the State of Maharashtra” (Volume 127).

“Status of storage and irrigation potential creation.

3.2 After preliminary surveys pre-feasibility reports of four projects are now prepared. Brief particulars of such projects are as follows.

Sr.	Name of Project	Water use for Irrigation Mcum	CCA Ha
1.	Virdi (Morachi Rai) MIP	8.95	370
2.	Virdi B MIP	4.49	160
3.	Dhangarwadi MIP	7.86	300
4.	Ambadgaon MIP	0.54	25

A Compilation of these pre-feasibility reports is filed in a separate booklet and marked as **Annexure-26** .”

1211.

However, in Para 3.2 of Volume 127, there is no mention of other identified projects / schemes, namely (i) Virdi – ‘C’ M.I.P., (ii) Talekhol M.I.P., (iii) Vazare M.I.P., and (iv) K.T. Weirs nor it is made clear whether these four projects / schemes [namely (i) Virdi – ‘C’ M.I.P., (ii) Talekhol M.I.P., (iii) Vazare M.I.P., and (iv) K.T. Weirs] have been found to be feasible / workable or not.

2467

1212.

In view of above mentioned state of affairs, the Tribunal considers it more appropriate to restrict the examination of the issues related to water demand in respect of following projects / schemes of the State of Maharashtra which are finally included in the “Further Amended Statement of Case of the State of Maharashtra” (Volume 127).

a. Virdi Large MI project – DPR at Volume 52A, 52B & 52C and revised DPR at 95(a)

b. Virdi (Morachi Rai) MI project – Pre-Feasibility Report at Volume 113(b)

c. Virdi B MI project – Pre-Feasibility Report at Volume 113(b)

d. Dhangarwadi MI project – Pre-Feasibility Report at Volume 113(b)

e. Ambadgaon MI project – Pre-Feasibility Report at Volume 113(b)

1213.

The details in respect of Virdi Large MI Project are available in the detailed project report (DPR). In respect of other

projects, the outline or broader features are provided in the feasibility report (FR).

2468

Examination of the Claims of the State of Maharashtra

Virdi Large Minor Irrigation Project

1214.

The Tribunal finds that the State of Maharashtra has filed the detailed project report (DPR) of Virdi Large Minor Irrigation Project as Annexure 19 in three Volumes (i.e. Volume 52A, Volume 52B and Volume 52C) on 17.10.2013. The said DPR was apparently prepared in the year 2005. During the visit of the Tribunal to the project site on 14.12.2013, the State of Maharashtra made available a copy of the salient features of the Project to the Tribunal. S ubsequently, " Revised Detailed Project R eport of Virdi Large M.I. Project" – Annexure-22 [Volume 95(a)] was filed by the State of Maharashtra on 18.9.2014. It was noticed by the Tribunal that there were considerable variations in the content of the information made available from time to time to the Tribunal. In view of this position, the Tribunal by its Order passed in IA-28 of 2014 on 11.2.2015, had directed the State of Maharashtra as under.

"…

6. On perusal of the record available with the Tribunal, the Tribunal finds as under:

“The Government of Maharashtra has provided detailed project report (DPR) and information related to Virdi Large Minor Irrigation Project to the Tribunal from time to time. It is noted that DPR of Virdi Large Minor Irrigation Project was first filed by the State of Maharashtra on 17.10.2013 as Annexure – 19 of the Statement of Case. Subsequently, Salient Features of the Project were made available during the visit of the Tribunal to the site in December 2013. Later on, a revised DPR has been filed on 18.9.2014.

There are considerable variations in the content of the information made available from time to time as may be seen from the following Table.

Important features	**Information included in the document filed / provided to the Tribunal**		
	in Oct. 2013	**in Dec. 2013**	**in Sept. 2014**
Location of the Dam	On Haltara	On Kattica	On Kattica

Height of the dam	40.33 meters	50.38 meters	61.98 meters
Length of the dam	238 meters	745 meters	810 meters
Water utilization	15.378 million cubic meters	14.697 million cubic meters	21.556 million cubic meters
Culturable Command Area	1405 hectares	1508 hectares	1979 hectares

It is also interesting to note that the revised DPR filed by the State of Maharashtra on 18.9.2014 clearly states that " *itwas decided in the meeting of Governing Council of Kokan Irrigation Development Corporation held on 12.08.2011 to increase the scope of Virdi Project to provide irrigation facilities to the above village in Tilari valley* ".

From above, it is apparent that the varying information were provided to the Tribunal and the Tribunal was not informed of the factual position.

7. As far as the facts which have been found by this Tribunal are concerned, the learned counsel for the State of Maharashtra seeks four weeks' time to file an affidavit explaining the considerable variation in the content of the information made available to the Tribunal from time to time. The prayer for the grant of time is not opposed by the learned counsel for the State of Goa. Therefore, the said prayer is accepted and a time of four weeks is granted to enable the State of

Maharashtra to file an affidavit explaining the variations indicated above.

…”

1215.

In compliance to the Order dated 11.2.2015 of the Tribunal, the State of Maharashtra filed the “Affidavit on behalf of the State of Maharashtra pursuant to the Order of this Tribunal on 11 th February 2015” on 16.3.2015 (Volume 111). In view of the revision of the scope of the Virdi Large M.I. Project as

contained in the “Revised Detailed Project Report of Virdi Large M.I. Project” – Annexure-22 [Volume 95(a)] and the clarifications provided in the Affidavit dated 12.3.2015, it is considered appropriate to examine the features in respect of Virdi Large M.I. Project as included in the “Revised Detailed Project Report of Virdi Large M.I. Project” – Annexure-22 [Volume 95(a)].

1216.

As per the “Revised Detailed Project Report of Virdi Large M.I. Project” – Annexure-22 [Volume 95(a)], the total utilization is 21.556 Mcum (0.76 tmc) comprising:

a. Irrigation demand within the Mahadayi river basin – 13.767 Mcum (0.48 tmc)

b. Irrigation demand outside the Mahadayi river basin (i.e., in the adjoining Tillari basin) – 5.631 Mcum (0.20 tmc)

c. Drinking water requirement – 0.218 Mcum (0.01 tmc)

d. Industrial water needs within Mahadayi river basin – 0.730 Mcum (0.03 tmc)

e. Losses – 1.210 Mcum (0.04 tmc)

Total – 21.556 Mcum (0.76 tmc)

1217.

There is a specific mention of irrigation demand

within the basin and outside the basin. Similarly, it is also clearly

stated that the industrial water demand is for Virdi command area i.e., for utilization within the Mahadayi river basin. However, it is not clearly mentioned whether the demand for drinking water is exclusively for utilization in the areas within the Mahadayi river basin or it is inclusive of both the areas within and outside the basin.

1218.

The water availability at the Virdi Large MI Project is indicated as 22.7 Mcum (0.80 tmc). It is, however, found by the Tribunal that the quantum of water required for ecological needs immediately downstream of the project site or for the lower reaches of the river (including that in the territory of the State of Goa) has not been estimated in the form of the environmental flow and accounted for, to arrive at the rational value of the utilizable water, out of available water at the site.

1219.

In this regard, an independent assessment of water availability at the project site has also been undertaken by the Tribunal. The water availability at 75% dependability as per the

assessment made by the Tribunal, works out to be 21.37 Mcum (0.75 tmc) against the value of 22.7 Mcum (0.80 tmc) assessed by the State of Maharashtra. The Tribunal has also estimated the

2473

quantum of environmental flow in accordance with the provisions in the “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA Notification 2006” (MARK -37) of the Ministry of Environment, Forest and Climate Change published in April 2015 as under.

a. Water Availability at 75% Dependability : (as assessed by the Tribunal) 21.37 Mcum

b. Water Availability at 90% Dependability : (as assessed by the Tribunal)

c. Environmental Flow @ 30% of the Water : Availability at 90% Dependability (the flow at proposed sites of diversion being only during the monsoon period)

d. Upper Limit of the Quantum of Water : that

could

be

considered

for

12.75 Mcum

3.83 Mcum

17.54 Mcum

Consumptive Uses within the basin and /

or for Diversions outside the basin (i.e.,

the

Water

Availability

at

75%

Dependability – the Environmental Flow)

2474

1220.

From the above, it is found by the Tribunal that after deducting the environmental flows, the maximum level of utilizable water at the Virdi Large MI Project could be 17.54 Mcum (0.62 tmc). However, after examining the requirements of water for various purposes projected by the State of Maharashtra, a total of 15.93 Mcum (0.56 tmc) comprising (a) proposed in-basin requirement of 13.767 Mcum (0.48 tmc) for irrigation, (b) proposed in-basin requirement of 0.730 Mcum (0.03 tmc) for industrial needs, (c) proposed requirement of 0.218 Mcum (0.01 tmc) for drinking water, and (d) losses of 1.210 Mcum (0.04 tmc), is permitted at the Virdi Large MI Project. The projected requirement of 5.631 Mcum (0.20 tmc) for irrigation demand outside the Mahadayi river basin (i.e., in the adjoining Tillari basin) is not granted in view of non-availability of adequate water, and also in view of the fact that at page 67 of the "Argument Notes by the State of Maharashtra" (Volume 221) filed by the learned Counsel for the State of Maharashtra on 15.1.2018, it is stated that the 'State of Maharashtra has only one

ongoing minor irrigation project with planned utilization of 0.5 tmc water’.

2475

The permission to the State of Maharashtra to plan Virdi Large MI Project for utilization of 15.93 Mcum (0.56 tmc) will be inclusive of all consumptive uses including the reservoir and other losses.

1221.

Considering the position elaborated in earlier paras, in respect of diversion of water of Mahadayi river basin outside the basin for utilization for different purposes other than the drinking water purposes, it is held by the Tribunal that the State of Maharashtra is hereby permitted to utilize a maximum of 0.56 tmc of water for Virdi Large MI Project which will include all consumptive uses and the reservoir and other losses, subject to strict condition that the State of Maharashtra must undertake revision of the project features and prepare a modified Detailed Project Report (DPR) to utilize a maximum of 15.93 Mcum (0.56 tmc) of water for various purposes within the basin.

1222.

It is clarified in clear terms that such utilizations would necessarily require thorough review and modification of

the detailed project reports by the Maharashtra State Government. It is also clarified that the proposals in the form of detailed project reports would be considered for implementation

only: (a) after technical appraisal of the proposed projects by the central agencies; and (b) after obtaining all mandatory clearances as required.

Proposed Virdi (Morachi Rai) Minor Irrigation Project, Virdi B Minor Irrigation Project, Dhangarwadi Minor Irrigation Project, and Ambadgaon Minor Irrigation Project

1223.

In addition to the ongoing project namely, Virdi Large MI project, the State of Maharashtra has also identified four more projects, namely (i) Virdi (Morachi Rai) Minor Irrigation Project, (ii) Virdi B Minor Irrigation Project, (iii) Dhangarwadi Minor Irrigation Project, and (iv) Ambadgaon Minor Irrigation Project in the “Further Amended State ment of Case of the State of Maharashtra” (Volume 127). The State of Maharashtra has not filed the detailed project report (DPR) of these four projects, but the broader features are indicated in the “Compilation of Pre - Feasibility Report and Salient Features of Proposed Projects in Mahadayi Basin” Annexure – 26 [Volume 113(b)] filed by the State of Maharashtra on 6.4.2015.

2477

1224.

Two important features i.e., water availability estimated at 75% dependability and the proposed annual utilization in respect of four projects are summarized in Table-2 under Para 1198.

1225.

It is found that the extent of utilization proposed by the State of Maharashtra is relatively lower than the water availability at 75% dependability assessed by the State of Maharashtra. However, an independent assessment of the water availability at 75% dependability at the four proposed project sites has also been made by the Tribunal. The Tribunal has also computed the environmental flow in accordance with the provisions in the “Stand ard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA Notification 2006” (MARK -37) of the Ministry of Environment, Forest and Climate Change published in April 2015. The assessment made by the Tribunal in respect of (a) water availability at 75% dependability, (b) the environmental

flow, and (c) the upper limit of the quantum of water that could be considered for consumptive uses within the basin are indicated in Table-3.

Table-3: Water Availability at 75% dependability (in Mcum), and Environmental Flow (in Mcum) Assessed by the Tribunal in respect of Four Proposed Projects of the State of Maharashtra

Sl. No.	Description	Virdi (Morachi Rai) MI Project	Virdi B MI Project	Dhanga-rwadi MI Project	Ambad-gaon MI Project
1.	Water Availability at 75% Dependability (as assessed by the Tribunal)	13.91	6.32	9.38	7.82
2.	Water Availability at 90% Dependability (as assessed by the Tribunal)	8.30	3.77	5.60	4.67
3.	Environmental Flow @ 30% of the Water Availability at 90% Dependability (the flow at proposed sites of diversion being only during the	2.49	1.13	1.68	1.40

	monsoon period)				
4.	Upper Limit of the Quantum of Water that could be considered for Consumptive Uses within the basin and / or for Diversions outside the basin	11.42	5.19	7.70	6.42

	(i.e., the Water Availability at 75% Dependability – the Environmental Flow)				

1226.

Thus it is found by the Tribunal that the quantum of water proposed to be utilized by the State of Maharashtra at the proposed three projects namely (i) Virdi (Morachi Rai) Minor Irrigation Project, (ii) Virdi B Minor Irrigation Project, and (iii) Ambadgaon Minor Irrigation Project are relatively much lower than the upper limit of the quantum of water that could be considered for consumptive uses after taking into consideration the environmental flows. In case of fourth project namely, Dhangarwadi Minor Irrigation Project, the annual utilization has been indicated as 7.86 Mcum which reasonably matches with the upper limit of the quantum of water that could be considered for consumptive uses assessed by the Tribunal.

1227.

In view of the above, the Tribunal finds that the four

proposed projects can be planned by the State of Maharashtra with the annual utilization as under.

Sl. No.	Projects / Schemes Proposed by the State of Maharashtra	Permissible Annual Utilization

2480

a.

b.

c.

d.

Virdi (Morachi Rai) Minor Irrigation :

Project

Virdi B Minor Irrigation Project :

Dhangarwadi Minor Irrigation Project

Ambadgaon Minor Irrigation Project

:

:

8.95 Mcum

= 0.32 tmc

4.49 Mcum

= 0.16 tmc

7.70 Mcum

= 0.27 tmc

0.54 Mcum

=0.02 tmc

A total of 0.77 tmc of water can be granted and is hereby granted in respect of 4 proposed projects, i.e. (a) 0.32 tmc for (Morachi Rai) Minor Irrigation Project, (b) 0.16 tmc for Virdi B Minor Irrigation Project, (c) 0.27 tmc for Dhangarwadi Minor Irrigation Project, and (d) 0.02 tmc for Ambadgaon Minor Irrigation Project, subject to following rider.

1228.

It is clarified in clear terms that such utilizations would necessarily require thorough review and modification of the detailed project reports by the State Government. It is also clarified that the proposals in the form of detailed project reports would be considered for implementation only: (a) after technical appraisal of the proposed projects by the central agencies; and (b) after obtaining all mandatory clearances as required, by law.

2481

1229.

For the foregoing reasons, the Statement of Claims, filed by State of Maharashtra partly succeeds. In all, the State of Maharashtra is granted 1.33 tmc of Mahadayi water for meeting the in-basin needs in respect of five projects i.e., (a) 0.56 tmc for Virdi Large MI project (b) 0.32 tmc for (Morachi Rai) Minor Irrigation Project, (c) 0.16 tmc for Virdi B Minor Irrigation Project, (d) 0.27 tmc for Dhangarwadi Minor Irrigation Project, and (e) 0.02 tmc for Ambadgaon Minor Irrigation Project, which will be inclusive of all consumptive uses including reservoir and other losses. Rest of the claims of the State of Maharashtra are hereby rejected.

STATE OF GOA

1230.

The Government of Goa, in its “Request for appointment of a River Water Disputes Judicial Tribunal under Section-3 of the Inter-State Water Disputes Act, 1956 as amended” vide its letter No. 68 -4/CE-WRD-DO-2002-03/208 dated 09/07/2002 addressed to the Secretary, Union Ministry of

Water Resources, Government of India, had mentioned about, the water demands in Paras 12.7, 12.8 and 13.0 of the said letter.

Government of Goa had also emphasized, the issues relating to adverse environmental impact and water needed to address those issues, in Para 15.0 of the said letter. The relevant Paras are reproduced hereunder.

“12.7 Therefore, Goa Government appointed a “Panel of Experts” for preparation of Master plan for the long term needs of water potential of the Mandovi river basin in Goa. This Panel submitted its report to Goa Government on 31.01.1999. A copy of this Master Plan was supplied to Karnataka Government on 10.01.2000 and the NWDA on 08.02.2000. A copy of the Executive Summary of this Master Plan is at **Annexure-9** .

12.8 The main observations and recommendations of the above “Panel of Experts” are:

i. Out of the total geographical area of 3702 Sq.km. of Goa state the Mandovi river basin occupies 1580 Sq.km. – i.e., 43% of the area of the State, spreading over six talukas of Sattari, Bicholim, Bardez, Tiswadi (Panjim), Sanguem and Ponda.

There are 192 villages in the Mandovi river basin in Goa state with a cultivable land of 91072 ha.

ii. The water requirement of Goa state from the Mandovi river basin by 2051 AD at 75% (for irrigation) to 100% (for water supply) would be as under.

a) Domestic water supplies 208 M.cum

b) Industrial water supplies 208 M.cum

c) Irrigation

2050 M.cum

2483

iii.

iv.

v.

vi.

d) Salinity control 158 M.cum

e) Forest management 50 M.cum

Total Requirement Of Goa State 2674 M.cum

Against the above projected annual requirement of 2674 M.Cum of water by 2051AD the water resources actually available in the Mandovi basin for conservation and utilization is only 1531 M.cum. This 1531 M.cum includes the entire 75% dependable waters generated in the upper reaches of the basin in Karnataka (584 M.cum) and Maharashtra (120 M.cum) and from 530 Sq.km. foothill zone of Goa state (827 M.cum). Water resources from the remaining portions of the Mandovi river basin in the final tidal and saline reach and the coastal plains cannot be

practically conserved and regulated.

Thus the Mandovi Basin is a water deficient basin in the perspective of water resources development planning. As such it is obvious that there is absolutely no scope for any diversion of water outside the basin to Malaprabha River.

Goa state has to substantially depend on the water resources generated in the upper reaches of the basin in Karnataka & Maharashtra even to meet 1531 M.cum, which is only a part of its projected need of 2674 M.cum.

…

13.0 Hydro power generation

13.1. Goa state has no power generation project of its own at present and is totally dependent on other states for its power needs – domestic, industrial, irrigation (lift) and tourism. Goa state, at present,

therefore, has a most inadequate, erratic and undependable power supply.

13.2 There is scope for substantial cheap, environmentally clean hydro power generation at places along the Mandovi river and its tributaries within the Goa state which would make Goa state less dependent on supply from neighbouring states and improve the quality, quantity and economics of power supply in Goa state. This would help in improving the overall economy and development of Goa state.

13.3 The proposed outside-the-basin diversion of the Mandovi river and its tributaries by Karnataka will mean not only loss of valuable, limited water resources and its beneficial uses in Goa state, but also a total loss of cheap and environmentally clean hydro power potential available within the state. After valuable hydropower generation within the basin in the state, the same water

would be beneficially used for domestic, industrial and tourism water supply needs and for irrigation and to sustain existing navigation. Outside-the-basin diversion of Mandovi river waters by Karnataka deprives Goa of this cheap and locally available hydropower potential and a total loss of water to the detriment of the basin needs.

…

15.0 Adverse environmental impact

15.1 The Mandovi is a short length river on the West coast of India in a very fragile environment. There is existing navigation on the river for about 40 kms of the river in the final reaches and sufficient flow and draft (depth) is needed for the survival of this established navigation. There is a very fragile balance between the fresh water flow and the sea tidal ingress and salinity. There is the important natural Goa Harbour, whose survival depends upon the delicate balance between sea and fresh water, siltation etc. There is also the existing fishing – an important and major economic activity of the people of Goa, which is dependent on the level of salinity, the sustenance of the river flows etc. There are also other environmental factors. It is apprehended that the proposed diversion of the Mandovi river waters by the Karnataka Govt. will have an adverse impact on all these well-established socio-

economic activities in Goa with disastrous environmental consequences.

15.2 The Karnataka Govt. had got an Environmental Impact Assessment done by NEERI. One of the terms of reference of the EIA Studies was that the NIO (National Institute of Oceanography) should be associated with the EIA Studies along with NEERI. However, the NIO was not associated in preparation of EIA Report by NEERI. The Goa Govt. got this report from NEERI examined by its Panel of Experts. The Panel sought certain clarifications on the said NEERI report, which was sent to Karnataka Government on 29.06.1999.

2486

Karnataka Govt. has not given satisfactory clarifications. Hence Goa Govt. has not accepted NEERI's environmental impact assessment studies based on incomplete and erroneous basic data fed by Karnataka Govt. and non-association of the NIO with the studies."

1231.

The Tribunal notes that in its "Request for appointment of a River Water Disputes Judicial Tribunal under Section – 3 of the Inter-State Water Disputes Act, 1956 as amended", the State of Goa had indicated, its water demand, in quantitative terms, only in respect of (a) domestic water supplies, (b) industrial water supplies, (c) irrigation, (d) salinity control and (e) forest management, as per the recommendations of the Panel of Experts. Specific demands, in quantitative terms, in respect of other aspects, particularly the

environmental

needs,

requirements for hydropower development (even though non-consumptive in nature), navigation etc. were not mentioned.

Statement of Case of the State of Goa

1232.

The State of Goa has filed the “Statement of Case by the State of Goa before Mahadayi Water Dispute Tribunal” (Volume 28) on 4.2.2013. The water demands for various

purposes, have been indicated in Para 189, on page 145 and Para 190, pages 145-146 of Volume 28. The State of Goa has, mentioned the demands of water, as per the recommendations of the Panel of Experts. Paras 189 and 190 of the “Statement of Case by the State of Goa before Mahadayi Water Dispute Tribunal” (Volume 28) are reproduced hereunder.

“ **189** .According to the Master Plan prepared by the Panel of Experts for Mandovi basin area in the State of Goa, the projected water requirement of the State of Goa, by 2051 AD would be as under:

a) Domestic water supplies

b) Industrial water supplies

c) Irrigation

d) Salinity control

e) Forest management

Total Requirement of Goa State

208 M.cum

208 M.cum

2050 M.cum

158 M.cum

50 M.cum

2674 M.cum

190 .It is stated that as against the above projected annual requirement of 2674 MCM of water by 2051 AD, the water resources actually available in the Mandovi basin for conservation and utilization would be only 1531 MCM. This 1531 MCM, includes the entire 75% dependable waters generated in the upper reaches of the basin in Karnataka (584 MCM) and Maharashtra (120 MCM) and from 530 Sq. km foothill zones of Goa State (827 MCM). It is not possible to conserve practically or regulate the water resources from the

remaining portions of the Mandovi river basin in the final tidal and saline reach and the coastal plains. Thus the Mandovi River Basin is a water deficient basin in the perspective of its needs and anticipated water resources development. As such, there is no scope for diversion of any water outside the Mandovi River basin to Malaprabha River in Karnataka. Goa substantially depends on all the water resources generated in the upper reaches of the basin in Karnataka & Maharashtra even to meet its 1531 MCM, need which is only a part of its projected over all need of 2674 MCM."

1233.

The Tribunal notices that, even in the "Statement of Case by the State of Goa before Mahadayi Water Dispute Tribunal" (Volume 28), the demands of water of Mahadayi river basin by the State

of

Goa

were

confined,

to

the

recommendations of the Panel of Experts.

1234.

Subsequently, the State of Goa filed the “Amended Statement of Case of the State of Goa” (Volume 65) on 7.3.2014. In the “Amended Statement of Case of the State of Goa” (Volume 65), an additional Para 18D is included which reads as under.

“ **18D** .It is therefore submitted that with the advances in the environmental and hydrological sciences, the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports)

2489

relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of long term water requirement."

1235.

In the "Amended Statement of Case of the State of Goa" (Volume 65), the projected requirements of water, however, were indicated as 2674 MCM at Para 189, which is same as indicated in its earlier "Statement of Case by the State of Goa" (Volume 28). However, it is worth noting that, additional Paras 190A, 190B and 190C are included in Volume 65, which are as under.

" **190A** .It is submitted that the Government of Goa appointed a "Panel of Experts" for preparation of a Master Plan for the long term needs of water potential of the Mahadayi river basin in Goa. The Panel submitted its Report to Goa Government on 31/05/1999. However, many changes have occurred in the landscape and the hydro-meteorology during the 15 years since then. The main changes are:

- 208Sq. Kms. of area in Mandovi river basin has been declared as a wild life sanctuary called Mhadei Wildlife Sanctuary in the Year 1999. This has brought in additional restrictions on hydrologic intervention which could not have been foreseen in 1999.
- In2010, the Union Ministry of Environment and Forests constituted an expert panel called “Western Ghats Ecology Expert Panel”, und er the

Chairmanship of Prof. Madhav Gadgil to study the ecology of Western Ghats, which includes Mandovi basin, to, inter alia, assess the current status of ecology of the Western Ghats region, and to make recommendations for the conservation, protection and rejuvenation of the Western Ghats Region. The Panel has submitted their report in 2011 and has made recommendations on land and water use in Western Ghats, which includes Mandovi basin, which can have far reaching implications on hydrologic intervention, implications which could not have been foreseen in 1999.

🕮 In2012, the Union ministry of Environment and Forests further constituted a High Level Working Group under the Chairmanship of Dr. K Kasturirangan to, *inter-alia* ,study the report by the “Western Ghats Ecology Expert Panel”, and to study the preservation of the ecology, environmental integrity and holistic development

of the Western Ghats in view of their rich and unique biodiversity. The said High Level Working Group has submitted their report in 2013 and has made recommendations on land and water use in Western Ghats, which includes Mandovi basin, which can have far reaching implications on hydrologic intervention, implications which could not have been foreseen in 1999.

- Theknowledge of effect of global warming, climate change, and its implication on rainfall and water resources, was relatively less known in 1999. During the 15 years since then, considerable research has taken place in the science of climate change and this research has advanced m ankind’s

understanding of these complex natural phenomenon, which can have far reaching implications on hydrologic intervention and such implications could not have been foreseen in 1999.

⏠ Mankind'sunderstanding of aquatic ecology and environmental flows was relatively less known in 1999. During the 15 years since then considerable research has taken place in the science of environmental flows and this research can have advanced mankind's understanding of the aquatic ecology, which can have far reaching implications on hydrologic intervention, implications which could not have been foreseen in 1999.

190B .The Panel of Experts in the said Report also had not taken into account requirements of water for navigation, environmental flows, depletion of marine resources, wildlife & sanctuary needs etc.

190C .For all these reasons aforestated, it is necessary to revisit the Master Plan prepared in 1999. The State of

Goa has launched many new studies towards this objective and after these studies are completed the water requirement would be worked out afresh."

1236.

From Para 18D and Para 190C of the "Amended Statement of Case of the State of Goa" (Volume 65), it is apparent that the State of Goa intends, to work out the long term water requirements afresh after completion of new studies launched by the State of Goa and the finalization of more

detailed studies and detailed project reports (DPRs) relating to various irrigation schemes.

Inconsistencies in Data / Information in Document filed by the States

1237.

The aspects of inconsistencies, in data / information relating to water availability and water requirements, projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case / Statement of Claims and related documents were examined in detail by Tribunal and the Tribunal passed an Order on 3.9.2014. The extracts from the Order dated 3.9.2014, which pertain to the State of Goa, in respect of water requirements, are reproduced hereunder.

“1. Today, during the course of hearing of the matter, the Tribunal has handed over copies of the “Brief Note on Inconsistencies in Data/Information related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case/Statement of Claims and Related

Documents” to the learned counsel appearing in the matter. Even copies of the draft order, which the Tribunal proposes to pass on the basis of the Brief Note, were also handed over to the learned counsel appearing in the matter. The Brief Note reads as under:

2493

1.Two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stakeholders and for different purposes are: (a) water availability assessed at various locations; and (b) water requirements for meeting the present and future demands of water for various purposes. In addition, information related to prioritization of water use keeping in view the socio-/economic profile of the areas are also considered necessary. Though the legal issues are undoubtedly very important but rational assessment of water availability and water requirements for various purposes on a sound and accepted principles remain basic inputs.

2. The statements of case / statement of claims, written statements and rejoinders submitted by the three co-basin States along with the related documents provide some information relating to these two basic inputs, the examination of the documents provided by the three States indicates that in many cases, the information

provided by the respective States are not consistent and in some cases are contradictory. Some inconsistencies were also observed by the Tribunal during the visit to various projects / sites etc. in the States of Goa, Karnataka and Maharashtra in December 2013 which are indicated in the report on the visit. Obviously, inconsistent informations cannot be the basis of meaningful arguments during the process of arriving at reasonable assessment of the available water resources and judicious allocation of share of waters among the various stakeholders and for different purposes.

2494

3. Without going into the merits of the facts as provided through data and informations included in the documents filed by respective State Governments and without comparing the data / information provided by one State with that of other States at this stage, some specific cases of inconsistencies in data / information appearing in the documents are cited as under.

4. In Para 72, page 49-50 of the Statement of Case of Goa, it has been mentioned "that total 75% yield from the whole of Goa Region of Mandovi / Madei Basin is 86.80 TMCft. (2460 MCM)". It has further been indicated in the same Para that "the total availability of water resources for developmental purpose could be only 54 TMCft (1531 MCM)". The total projected demand of water by the year 2051 has been reported by Goa as 2674 MCM in Para 189 on page 145 of the Statement of Case of Goa. ***The projection of demand of 2674 Mm 3 against the utilizable available water of 1531 Mm 3 , in itself appears to be quite illogical.*** *Followingpertinent*

inconsistencies / contradictions are also observed from the Statement of Case and related document submitted by Goa.

a. *Goahas raised serious objections on the hydrological data observed at Ganjim on river Mahadayi and Colem on river Khandepar (a tributary of river Mahadayi) which has been used by Central Water Commission (CWC) as well as National Water Development Agency (NWDA) for assessment of water availability. The issue of unreliability of data observed at Ganjim was also raised by Goa during the visit of the Tribunal to*

various projects / sites in the State of Goa, Karnataka and Maharashtra in December 2013. However, the Tribunal noted that neither Central Water Commission nor Water Resources Departments of Government of Goa, Government Karnataka and Government of Maharashtra undertook detailed studies for consistency checks of the observed data at the site. ***Any conclusion about reliability or otherwise of observed hydrological data without proper consistency checks would not be appropriate.***

b. *Inits Statement of Case, Goa has also adversely commented on the assessment of water availability by National Water Development Agency (NWDA). Goa has mentioned in Para 178, page 130 that "these NWDA's water resources assessments are now revealed to be based on* ***erroneous assumption of basic hydrological data such as rainfall, river discharge data……*** *".Goa,*

on the other hand, appointed a "Panel of Experts" for preparation of Master Plan for the long term needs of water potential of Mahadayi river basin in G oa and has referred to the report of the "Panel of Experts" time and again. It is, however, noted that the studies of the "Panel of Experts" relating to water availability are primarily based on the findings of the technical study of NWDA as can be observed from Para 179, page 130 of the Statement of Case of Goa. ***This presents a contradictory situation.***

c. Goa has not agreed with the results of the studies of Central Water Commission regarding the assessment of water availability and has stated in Para 30, p age 33 of "Reply by the State of Goa to Statement of Claims filed by the State of Karnataka before Mahadayi Water Dispute Tribunal" that "…… Goa will submit its case of quantification of useful and reliable yield available in Mandovi Basin before this Hon' ble Tribunal for its perusal and decision in due course." Further, in the Amended Statement of Case filed by Goa on 7.3.2014, it has been mentioned at Para 18D, page 15- 16 that "it is therefore submitted that with the advances in environmental and hydrological sciences, the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of long term water requirements". ***However, Goa has***

not indicated any timeframe for completion of detailed studies and individual DPRs. Therefore, at present, the projected demand of 2674 Mm 3 of water for various purposes by Goa cannot be treated as final projection.

…

4. In view of the important issues highlighted in the "Brief Note on Inconsistencies in Data/Information related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case/Statement of Claims and Related Documents" ("Brief Note", for

short), which have been brought to the notice of the learned counsels representing the three States and in view of the consensus about some data/information in various documents being inconsistent and/or incomplete, the Tribunal proposes to exercise the powers conferred on it by Sections 9(1)(ba), 9(2) and 9A of the Act and give directions to the three party States as well as the Central Government, with a view to secure required material, data as well as carry out surveys and investigations and to produce relevant data before it to enable the Tribunal to decide the two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stake holders, which have been highlighted in the “Brief Note”.

(1) The State of Goa is directed to submit its case of quantification of useful and reliable yield available in Mandovi Basin before the Tribunal for its perusal and decision in due course, on or before 2.12.2014.

(2) The State of Goa is directed to complete the process already undertaken by it for more detailed studies and preparing individual Details Project Reports (DPRs) relating to the irrigation schemes in order to arrive at revised quantum of long term water requirements, on or before 2.12.2014.

…"

1238.

In response to the above said Order of the Tribunal, the State of Goa filed the compliance report on 22.12.2004

through “Submission of the State of Goa in Compliance with Paragraph 4 of the Order dated 03/09/2004 passed by this Honourable Tribunal” (Volume 101). The response of the State of Goa to paragraph 4(2) of the said Order is reproduced hereunder.

“15. At the outset, it is clarified that the long -term water requirement is estimated not only for irrigation. Water is also required for hydro-power, drinking purpose, industrial use, environmental flows, inland navigation, salinity control and maintenance of appropriate river morphology. A Detailed Project Report (DPR) can be prepared only fo r a ‘project’ and that too involving irrigation, hydro-power and drinking-water purpose. DPRs cannot be prepared for the use which is not a “project” viz. industrial use, environmental flows, inland navigation and for maintenance of appropriate river morphology. Therefore it is respectfully submitted that Goa’s long term water requirement cannot be determined only by what is stated in the DPR. Moreover, even for the irrigation, hydro-power and

drinking water purpose, it is standard practice that the DPRs are prepared only when the project is to be taken up for construction. Estimation of water needs is not done by preparing DPRs and therefore estimation of water needs cannot be restricted to the quantum reflected in the DPRs.

16. As a matter of fact, State of Goa is in the process of undertaking one more study for ascertaining the water requirement for environmental flow, salinity control, inland navigation and river morphology. The State of

2499

Goa craves leave to refer to and rely upon copy of the said study r eport once the same is completed."

1239.

From the above said statement of the State of Goa in response to paragraph 4(2) of the said Order dated 3.9.2014 of the Tribunal, it is apparent that the projected water requirements of the State of Goa, were not ascertained fully, till the submission of the response to the Tribunal's Order dated 3.9.2014. It is found by the Tribunal that the content of reply of the State of Goa at Para 16 of the "Submission of the State of Goa in Compliance with Paragraph 4 of the Order dated 03/09/2004 passed by this Honourable Tribunal" (Volume 101), virtually contradicts, the assertions made by the State of Goa, in Para 18D of the "Amended Statement of Case of the State of Goa" (Volume 65), wherein it is stated that the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes, in order to arrive at revised quantum of long term water requirements. Para 18D of the "Amended St atement of Case of

the State of Goa” (Volume 65) is once again reproduced hereunder.

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“ **18D** .It is therefore submitted that with the advances in the environmental and hydrological sciences, the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of long term water requirement .”

[Emphasis supplied]

1240.

It is noticed by the Tribunal that, the State of Goa filed “Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by State of Karnataka on 24/01/2014” (Volume 103) on 24.12.2014. Alongwith the said

Affidavit, the State of Goa submitted the detailed project reports (DPRs) in respect of 59 projects, mentioned in Annexure-18 of Master Plan for Madei / Mandovi River Basin.

1241.

The State of Goa revised its Statement of Case and filed the “Amended Statement of Case of the State of Goa (Volume 131) on 23.4.2015. It is observed by the Tribunal that there are no changes in respect of the projected water requirements of the State of Goa, and that the contents of Paras 189, 190, 190A, 190B and 190C of the “Amended Statement of Case of the State of Goa” (Volume 65) filed on 7.3.2014 and that of the “Amended Statement of Case of the State of Goa filed

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before the Mahadayi Water Disputes Tribunal" (Volume 131) filed on 23.4.2015, are exactly the same.

1242.

It is, however, noticed by the Tribunal that Paras 15 and 16 of the compliance report i.e., "Submission of the State of Goa in Compliance with Paragraph 4 of the Order dated 03/09/2004 passed by this Honourable Tribunal" (Volume 101), have been included, as additional paragraphs 18D(i) and 18D(ii) in the "Amended Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal" (Volume 131).

1243.

It is also found by the Tribunal that, additional 36 paragraphs i.e., Para 190C(i) to Para 190C(xxxvi), have been included in the "Amended Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal" (Volume 131). However, the Tribunal finds that these additional paragraphs, do not help in quantification of the long term water requirements of the State of Goa, in respect of Mahadayi water.

1244.

The State of Goa has not informed the Tribunal

whether the studies referred to in Para 18D and Para 190C of the

“Amended Statement of Case of the State of Goa filed be fore the

2502

Mahadayi Water Disputes Tribunal" (Volume 131), have been completed or not. Similarly, the State of Goa has not informed the Tribunal about the Changes in the water requirements, as a result of the finalization of the detailed project reports (DPRs) of the 59 projects, which have been filed by the State of Goa in response to the interrogatories administered by the State of Karnataka.

Existing Utilizations

1245.

The Tribunal notes that the State of Goa, has not specifically reported, details of the existing utilization of water of Mahadayi river basin. However, on the basis of the information provided by the State of Goa, particularly in response to the interrogatories administered by the State of Karnataka, the Tribunal finds that the State of Karnataka has estimated the existing utilization of water of Mahadayi river basin by the State of Goa as 9.395 tmc. The figure of existing utilization of 9.395 tmc by Goa, has not been contested by the State of Goa. Therefore, the existing utilization of water of Mahadayi river

basin by the State of Goa is taken as 9.395 tmc by the Tribunal.

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Changes Suggested by the Witnesses Appearing on Behalf of State of Goa

1246.

The Tribunal observes that, although the State of Goa has not informed, about the outcome of the additional studies or the changes emerging out of the finalization of the detailed project reports (DPRs) of the 59 projects, the following witnesses appearing on behalf of the State of Goa have mentioned about the quantity of water required for some specific purposes.

a. Shri Paresh Porob (AW-2)

b. Shri Rajendra P. Kerkar (AW-4)

c. Shri Subrai T. Nadkarni (AW-5)

1247.

At para 10 on pages 5-6 of his Additional Affidavit dated 17.11.2017 (Volume 214), Shri Paresh Porob has stated as under.

“10. I state that in so far as forest management is concerned, 50 MCM is stated to be the requirement which is as per the Master Plan of Madei basin, dated

May 1999 (Vol. No. 62C, Annexure 120, Volume-I), prepared by the Panel of Experts (“PoE”). I state that same finds mention on page 53, at paragraph 5.5.0 which reads as under:-

2504

“Since large forest area falls in the command area for the forest management and irrigated forest an area of 100 SqKms is considered. With a delta of 0.50 m, the requirement for this purpose works to 50 MCM.”

It is apparent that Shri Paresh Porob has merely quoted from the Report of the Panel of Experts without mentioning his views, as an expert, about adequacy or otherwise about the projected water requirement for forest management. Subsequently, in para 11 on page 6 of his Additional Affidavit dated 17.11.2017 (Volume 214), Shri Porob has stated that the figure of 50 Mcum excludes the water requirement of wildlife in Madei Wildlife Sanctuary. The para 11 on page 6 of Volume 214 is reproduced hereunder.

“11. I state that when the Panel of Experts prepared the Report in the years March 1998 to May 1999, Madei, Wild Life Sanctuary was not declared. I state that the Wildlife sanctuary have a completely different requirements of their own. I state that the figure of 50

MCM excludes the water requirement of wildlife in Madei wildlife Sanctuary."

1248.

On a closer examination of para 5.5.0 on page 53 of Volume – I of the Report of the Panel of Experts, the Tribunal notices that the specifi c reference is about "large forest area" falling in the command area and that the projected requirement of 50 Mcum primarily relates to "irrigated forests", covering 100 square kilometres of the forest area falling in the command area.

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1249.

The Tribunal also notices that in subsequent para i.e.,

para 13, Shri Porob states that “the water requirement for Madei Wildlife Sanctuary is shown in Table 1.1”. The Table 1.1 included in the Additional Affidavit of Shri Porob is reproduced hereunder.

“ **TableNo. 1.1 below shows the Type of Requirement in Surla and Madei River (In MCM)**

Type of Requirement	Surla River (IN MCM)	Madei Stem (IN MCM)
Domestic requirement	0.325	22.521
Livestock consumption	0.05	3.38
Irrigation	79.92	1162.43
Environment flow	124.51	411.20

(Source: Water Balance Study by Mr. S. T. Nadkarni Chief Engineer Water Resources Department, Government of Goa)”

1250.

The Tribunal notes that Shri Porob has stated that

“the water requirement for Madei Wildlife Sanctuary is shown in Table 1.1”. However, the Table 1.1 prepared by Shri Porob includes: (a) domestic requirement; (b) livestock consumption; (c) irrigation; and (d) environmental flow. It is noticed that the

requirements for various purposes mentioned in Table 1.1, are same as assessed by Shri Nadkarni and reported in Table 12 on page 64 of his Affidavit dated 14.11.2017 (Volume 208). Shri Porob has not explained as to why the irrigation requirement or domestic need or livestock consumption or environmental flow assessed by Shri Nadkarni in respect of two sub-basins namely Surla and Madei stem are to be considered as “the water requirement for Madei Wildlife Sanctu ary”. In this context, it is also noticed that in the Table 12 on page 64 of his Affidavit dated 14.11.2017 (Volume 208), Shri Nadkarni has separately indicated a provision of 50 Mcum towards forest management. Therefore the contention of Shri Porob in par a 13, about “the water requirement for Madei Wildlife Sanctuary” cannot be accepted.

1251.

Interestingly, Shri Porob has assessed the demand of water for wildlife management in Mahadayi basin and that for nurseries for forests in Mahadayi river basin and discussed the same in para 24 and para 25 respectively of his Additional Affidavit (Volume 214). The detailed computations are furnished

by Shri Porob in Table 1.3 on pages 15-16 and Table 1.4 on page 17 of his Additional Affidavit dated 17.11.2017 (Volume 214).

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1252.

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the

water

requirement for meeting the demand of water for wildlife management in Mahadayi river basin in Table No. 1.3, on pages 15- 16 of his “Additional Affidavit in Evidence of Shri Paresh Porob, Witness of the State of Goa Deposing on Wildlife and Forest” (Volume 214). The water demands, indicated by him are as under.

a.

Quantity of water required for =

present Water Holes (17 nos. in

Madei Wildlife Sanctuary, 13 nos.

in Bhagwan Mahavir Wildlife

Sanctuary and 8 nos. in Bondla

Wildlife Sanctuary)

11400 Cum

or 0.0114 Mcum

or 0.0004 tmc

b. Quantity of water required for =

Water Holes envisaged in 2050 (40

nos. in Madei Wildlife Sanctuary,

48 nos. in Bhagwan Mahavir

Wildlife Sanctuary and 8 nos. in

Bondla Wildlife Sanctuary)

28800 Cum

or 0.0288 Mcum

or 0.001 tmc

1253.

Shri Porob has also assessed the water requirement for maintenance of the nurseries for forests in Madei Wildlife Sanctuary and Bhagwan Mahavir Wildlife Sanctuary in the Mahadayi river basin. In the Table 1.4, on page 17 of the

2508

Additional Affidavit in Evidence of Shri Paresh Porob (Volume 214), he has mentioned about the water demands of the State of Goa in respect of nurseries for forests in Madei Wildlife Sanctuary and Bhagwan Mahavir Wildlife Sanctuary in the Mahadayi river basin. The water demands indicated by him, for this purpose are as under.

a.

Quantity of water required for = present nurseries (6 nos. in Madei Wildlife Sanctuary and 2 nos. in Bhagwan Mahavir Wildlife Sanctuary)

19200 Cum

or 0.0192 Mcum

or 0.0007 tmc

b. Quantity of water required for = nurseries envisaged in 2050 (25 nos. in Madei Wildlife Sanctuary and 25 nos. in Bhagwan Mahavir

Wildlife Sanctuary)

120000 Cum

or 0.12 Mcum

or 0.0424 tmc

1254.

The Tribunal notices that, Shri Rajendra P. Kerkar has assessed, the water requirements for environmental flows for different sub-basins as also for the main Mahadayi river under Recommendation 5, on pages 40- 42 of the “Affidavit in Evidence of Shri Rajendra P. Kerkar, an Expert Witness of the State of Goa Dep osing on Environment, Ecology and Forest” (Volume 211).

2509

Shri Kerkar has concluded that the preferable level of water requirements, for environmental flows, for the entire Mahadayi basin, should be 1417.8 Mcum (50.1 tmc). He has also stated that, the water requirements, for environmental flows, for the entire Mahadayi basin, should not be less than 809.0 Mcum (28.6 tmc).

1255.

Shri Subrai T. Nadkarni, witness of the State of Goa, has revised the assessment of the water requirements for irrigation, domestic and industrial uses by using the basic data provided in the Master Plan prepared by the Panel of Experts. In Para 18,on page 42 of the “Affidavit in Evidence of Shri Subrai T. Nadkarni, Deposing as a State Witness on behalf of the State of Goa” (Volume 208), he has stated as under.

“18. The water requirement for irrigation, domestic and industrial uses has been estimated for each sub-basin and also for the main Mahadayi basin using the basic data provided in the Master Plan by the Panel of Expe rts.”

1256.

The detailed water requirements for various purposes

are indicated in Table-12 on page 64 of the “Affidavit in Evidence

2510

of Shri Subrai T. Nadkarni, Deposing as a State Witness on behalf of the State of Goa" (Volume 208).

1257.

The Tribunal finds that, in Table-12, on page 64 of Volume 208, Shri Nadkarni has, taken the requirements, for environmental flows, as per the assessment made by Shri Rajendra P. Kerkar and indicated in Recommendation 5, on pages 40- 42 of the "Affidavit in Evidence of Shri Rajendra P. Kerkar, an Expert Witness of the State of Goa Deposing on Environment, Ecology and Forest" (Volume 211).

1258.

It is, however, found by the Tribunal that, Shri Subrai T. Nadkarni, has not considered and adopted the requirements of water, for wildlife management and forest management as per the assessment made by Shri Paresh Porob and indicated in Table No. 1.3, on pages 15-16 and Table 1.4, on page 17 respectively, of the "Additional Affidavit in Evidence of Shri Paresh Poro b, Witness of the State of Goa Deposing on Wildlife and Forest" (Volume 214). Shri Porob has assessed (i) the quantity of water

required for Water Holes envisaged in 2050 (40 nos. in Madei Wildlife Sanctuary, 48 nos. in Bhagwan Mahavir Wildlife Sanctuary and 8 nos. in Bondla Wildlife Sanctuary) as 0.0288

2511

Mcum, and (ii) the quantity of water required for nurseries, envisaged in 2050, (25 nos. in Madei Wildlife Sanctuary and 25 nos. in Bhagwan Mahavir Wildlife Sanctuary), as 0.12 Mcum only. However, Shri Nadakarni has adopted a value of 50 Mcum for forest management. The Tribunal notes that, Shri Nadkarni has not stated the reason for adopting a value different from what has been mentioned by Shri Paresh Porob, the Expert Witness.

1259.

The Tribunal further observes that, there are considerable variations, in the assessment of the water requirements, made by Shri Subrai T. Nadkarni and that indicated by the Panel of Experts. Based on the information available in Para 189 of Volume 131 and the Table-12, on page 64 of Volume 208, the comparative statement has been prepared by the Tribunal and the same is shown in the following Table-1.

Table-1: Comparison of Water Requirements (in Mcum) assessed by POE and Shri Nadkarni

Sl. No.	Purpose	As per Panel of Expert (as indicated at Para	As per assessment by Shri Nadakarni,

		189, Vol. 131)	(Table-12, Vol. 208)
1.	Domestic water supply	208.00	41.36*

2.	Industrial water supply	208.00	96.42
3.	Irrigation	2050.00	2451.73
4.	Salinity control	158.00	-
5.	Forest management	50.00	50.00
6.	Tourism	-	23.07
7.	Environmental needs	-	808.94
	Total	2674.00	3471.52

[* including water requirements for livestock]

1260.

As indicated in Para 1257, Shri Nadkarni has adopted the recommendations of Shri Rajendra P. Kerkar, in respect of the environmental needs. However, the recommendations of Shri Rajendra P. Kerkar have been examined by the Tribunal separately, while examining the claims of the State of Karnataka

from Para 1035 to Para 1037 under the section “Environmental Considerations in Water Resources Planning”. In view of the position that has emerged, during the examination of the recommendations of Shri Kerkar, the Tribunal concludes that, the recommendations of Shri Rajendra P. Kerkar, witness of the State of Goa, in respect of environmental flow, cannot be accepted.

2513

1261.

From the Table-1, it is found by the Tribunal that, the water requirements assessed by Shri Subrai T. Nadkarni in respect of drinking water supply and industrial needs are on lower side. On the other hand, Shri Nadkarni has assessed, relatively a higher requirement of water for irrigation.

1262.

The irrigation water requirements assessed by Shri Nadkarni is relatively higher than the irrigation water requirements assessed by the Panel of Experts, mainly because Shri Nadkarni has adopted irrigation intensity of 150%, whereas the Panel of Experts, has considered the irrigation intensity of 125%, as is apparent from the statement of Shri Nadkarni in Para 19 at page 42, Para 23 at pages 43-44 and Table 11 at page 64 of the “Affidavit in Evidence of Shri Subrai T. Nadkarni, Deposing as a State Witness on behalf of the State of Goa” (Volume 208).

1263.

What is important to notice is that both, Shri Nadkarni as well as the Panel of Experts have assumed that, all the

cultivable area could be brought under irrigation by development of projects on rivers or its tributaries which has no factual basis, at all. The factors such as (a) topography of the area, (b) specific

location of the project site, and (c) the availability of water at the project site, decide the command area to be irrigated through any project. In addition, lift irrigation schemes can also be considered. However, the lift irrigation schemes will require detailed investigations including the availability of power needed for operation of such schemes and the economic aspects of such proposals. It is noticed that, these aspects have not at all been examined – either by Shri Nadkarni or by the Panel of Experts.

1264.

The Tribunal observes that, the irrigable area of 39773 Ha only is shown in the Annexure 18, page 125 of the "Master Plan for Madei / Mandovi River Basin (Volume II)", although the total of the irrigable area of 61 projects has been worked out by the Tribunal as 45675 Ha. The Tribunal also observes that the total irrigable area of 53543 Ha has been reported by the State of Goa in the "Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the State of Karnataka on 24/01/2014" (Volume 103), on the basis of the detailed project reports (DPRs) of the 61 projects filed by the

State of Goa.

2515

1265.

At Para 5.6.2, page 54 of the “Master Plan for Madei / Mandovi River Basin (Volume I)”, the Panel of Experts have stated as under.

“5.6.2. There seem to be no justification to voluntarily limit the ultimate area of irrigation in the Mandovi river basin just to 60% of culturable area as done by NWDA. The Mandovi river basin has adequate water resources but limited culturable area .As the land potential cannot be increased the only alternative left to increase the food and other agricultural production in Goa is to increase the production per hectare by intensive irrigation by double or triple cropping over the entire culturable area to the extent possible. The NWDA itself contemplates lift up to 120 metres and transportation of water over long distance as may be required. This will be in tune with the National need for maximising agricultural production for the perspective population of India .The present concept of projects based on gravity

canals or very small lifts may not be the practice in the long term when population and food needs increase rapidly. The ultimate reality may be intensive irrigation of atmost the entire culturable area of 91,072 ha. (Annexure 17)”

[Emphasis supplied]

1266.

It is noted by the Tribunal that, the Panel of Experts opines that the Mahadayi river basin has adequate water resources. Apparently, the panel of Experts suggested the

intensive irrigation by double or triple cropping, with the objective of maximising the use of the ‘adequate water resources’. Another point worth not ing is the Statement of the Panel of Experts that ‘this will be in tune with the National need for maximising agricultural production for the perspective population of India’. It is evident that, the planning for irrigation is not to meet the demand of the State of Goa in respect of agricultural produce but to maximise the utilization of available water resources.

1267.

Relevant Paras from Annexure 17, page 124 of the “Master Plan for Madei / Mandovi River Basin (Volume II)”, are reproduced hereunder.

“ Working out the requirement of water projectwise after carrying out detailed survey, investigation and colleting hydrological data for sufficient long time is not possible considering the short time available forthe POE to finalise the Master Plan for use of water potential in the Mandovi river basin.

Considering the above aspect and secondly since this planning is to be done for the ultimate use of land available for cultivation by providing irrigation facilities in the Mandovi river basin ,the details of cultivable land available in each village falling within the river basin

2517

have been collected from the Land Survey Department.

…”

[Emphasis supplied]

1268.

Shri Subrai T. Nadkarni has proposed to increase the irrigation intensity from 125% adopted by the Panel of Experts to 150%. Para 23, pages 43-44 of the “Affidavit in Evidence of Shri Subrai T. Nadkarni, Deposing as a witness on behalf of the State of Goa” (Volume 208) is reproduced hereunder.

“23. The Panel of Experts has estimated the irrigation water requirement at a delta of 1.5 mts. and 20% losses. The intensity of irrigation assumed by the Panel of Experts was 125%. However, this is now outdated and the intensity of irrigation of projects in command like Anjunem is 220% and Tillari is 145%. Accordingly an intensity of irrigation of 150% has been adopted which is normally the case for minor irrigation projects in this State too. …”

1269.

The Tribunal finds that, the irrigation intensity cannot be adopted simply by looking at the values which were adopted in respect of other projects. Apart from the soil characteristics from view point of agricultural produce, social preferences for various crops and economy, a very important aspect related to the availability of utilizable water at different identified project

sites have to be taken into consideration. The Tribunal is of the view that any planning for cropping pattern, without looking at the availability of utilizable water at different identified project sites, is meaningless. Shri Nadkarni has not at all examined and explained, the various aspects, particularly the aspect of availability of utilizable water at different project sites, identified by the Panel of Experts.

1270.

The Tribunal also finds that, at Para 18D of “Amen ded Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal” (Volume 131), the State of Goa has submitted that “ with the advances in the environmental and hydrological sciences, the State of Goa is in the process of undertaking more detailed studies and individual DPRs (Detailed Project Reports) relating to the aforesaid Irrigation Schemes in order to arrive at revised quantum of long term water requirement”. Further, at Para 190C of “Amended Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal” (Volume 131), the State of Goa indicates that

the “State of Goa has launched many new s tudies towards this objective and after these studies are completed, the water requirement would be worked out afresh”.

2519

1271.

The Tribunal notices that, while presenting his case for revised assessment of water requirement, Shri Subrai T. Nadkarni has not at all mentioned about any new studies indicated by the State of Goa in Para 18D and Para 190C of the “Amended Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal” (Volume 131).

1272.

The Tribunal further finds that, Shri Subrai T. Nadkarni has neither undertaken any scientific study nor mentioned about the scientific studies undertaken by the State of Goa or by him, to examine the claims of the State of Goa in respect of (a) impact of diversion of water outside the basin and / or abstraction of water within the basin by co-basin States, including the State of Goa, for meeting the demand of water for various purposes (such as, drinking water, irrigation, power generation, industrial needs, etc.) on navigation, (b) impact of diversion of water of Mahadayi river basin on irrigation in the

State of Goa, (c) impact of diversion of water of Mahadayi river basin on sea level increase and increased salinity ingress in coastal areas of Mahadayi river with due consideration of the scientifically predicted global warming, (d) impact of reduction in

flow in river Mahadayi, if any, due to diversion of water of Mahadayi river basin on the process of sedimentation, (e) effect of diversion of water of Mahadayi river basin on the agriculture in Mahadayi River Basin in the State of Goa, and (f) impact of diversion of water by States of Karnataka and Maharashtra, on the ground water flow pattern. This is apparent from answers to question Nos. 1, 8, 13, 15, 16 and 17 put to Shri Subrai T. Nadkarni by the Tribunal. The question Nos. 1, 8, 13, 15, 16 and 17 and the answers thereof are reproduced hereunder.

“Q.No.1. At Para 28, page 13 of your Affidavit dated 14.11.2017 (Vol. 208), you have stated as under:

“28. Hence inland waterways being a way of life and lifeline of Goa, diversion or abstraction by the State of Karnataka of any water will severely affect the navigational traffic.”

In this regard, please answer the following:

a. Has any scientific study been undertaken and/or completed by the Government of Goa to examine the impact of diversion of water outside the basin

and / or abstraction of water within the basin by co-basin States, including the State of Goa, for meeting the demand of water for various purposes (such as, drinking water, irrigation, power generation, industrial needs, etc.) on navigation?

b. Is there any study which indicates the impact of diversion / abstraction of water for various purposes on navigation in quantitative terms?

Ans. Before submitting the Statement of Claim and the Amended Statements of Claim, I had read each sentence and all paragraphs of the said Statement of Claim and Amended Statements of Claim, respectively, and I reiterate and standby each sentence and paragraph in the said Statements. The said Statements/Pleadings may be considered as my evidence on oath.

The State of Goa made attempts to examine the impact of diversion/ abstraction of water outside the basin by all the States on navigation. However, due to absence of data on sedimentation, as Ganjim G&D site did not measure any such data, inferences could not be drawn from the studies, especially as regards to navigation. However, there would be definitely some effect if water is diverted to outside the basin, as utilization in the basin itself will result in return flows in the river.

[Emphasis supplied]

Q.No.8. At Para 23, pages 43-44 of Annexure II of your Affidavit dated 14.11.2017 (Vol. 208), you have stated as under:

"… The global warming and climate c hange are expected to impact the irrigation water requirement in several ways. Because of increased atmospheric temperature the evapo-transpiration will increase, and the losses by direct evaporation from water bodies, reservoirs, canal surfaces and farms will also increase. …"

2522

We observe that you have indicated about the likely impact of global warming and climate change on irrigation water requirement. However, you have not at all mentioned about the impact of global warming and climate change on the overall water availability of Mahadayi basin.

In this regard, please answer the following:

a. What are the likely impacts of global warming and climate change on water availability of Mahadayi basin and the quantity of likely increase or decrease in the waters of Mahadayi basin, say by 2050AD?

b. What is the estimated quantity of the losses due to increase in evapo-transpiration, direct evaporation from water bodies, reservoirs, canal surfaces and farms, etc.?

Ans. I will answer this question in two parts:

a. Though there would be impact of global warming on the water availability in the Mahadayi basin,

the State of Goa has not estimated the same.

b. The estimated quantity of losses in each project, due to increase in evapo-transpiration, direct evaporation from water bodies, reservoirs, canal surfaces and farms, etc. has also not been estimated.

[Emphasis supplied]

2523

Q.No.13. Has the Government of Goa carried out any scientific studies related to sea level increase and increased salinity ingress in coastal areas of Mahadayi river with due consideration of the scientifically predicted global warming? If so, what are the findings?

Ans. No such scientific study has been conducted by the Government of Goa.

[Emphasis supplied]

Q.No.15. Has the Government of Goa examined and conducted any scientific studies related to impact of reduction in flow in river Mahadayi, if any, on the process of sedimentation? If such studies have been conducted, what are the findings thereof?

Ans. The State of Goa had commissioned a Study through DHI. However, due to lack of data on sediment flow in the river, the study on sedimentation could not come to a logical conclusion.

[Emphasis supplied]

Q.No.16. Has the Government of Goa examined and/or

undertaken scientific studies about the effect of diversion of water by States of Karnataka and Maharashtra on the agriculture of Mahadayi River Basin in the State of Goa?

If such studies have been undertaken, what are the findings thereof?

Ans. No such study has been conducted by the State of Goa.

[Emphasis supplied]

2524

Q.No.17. Has the State of Goa commissioned any scientific studies regarding the impact of diversion of water by States of Karnataka and Maharashtra on the ground water flow Pattern? If such studies have been commissioned, what are the findings thereof?

Ans. No such study has been conducted by the State of Goa, through any external agency. However,the Water Resources Department of the State of Goa had analyzed some of the effects at its o wn level."

[Emphasis supplied]

1273.

Thus, it is found by the Tribunal that, the studies by Shri Subrai T. Nadkarni have not been undertaken with due consideration of all aspects, particularly (a) the water availability that can be utilised for the benefit of the society, and (b) the needs projected by the co-basin States. In this regard, the question No. 4 put to Shri Nadkarni by the Tribunal and the answer thereof are relevant and are, therefore, reproduced hereunder.

“Q.No.4. In the Table at Para 30, pages 14 -15 and in the Table 13, page 65 of your Affidavit dated 14.11.2017 (Vol. 208), you have indicated the sub-basin wise availability of water (in Mcum) at 75% dependability in the second column. In the third column, you have

indicated the recommended demand and the fourth column shows the minimum required demand of water. In this regards, please answer the following:

a. From perusal of the contents of Para 17 to Para 30 of Annexure II of your Affidavit dated 14.11.2017 (Vol. 208), it is apparent that you have computed the demand of water for various purposes for the State of Goa only. Therefore, your study indicating the water balance of different sub-basin of Mahadayi basin, cannot be considered as correct representation of the water balance of the sub-basin. For proper appreciation of the water balance of different sub-basins of the Mahadayi basin, it is essential to assess the water availability for each of the sub-basin (after considering the total area of the sub-basin) as also the complete demand of water for each of the sub-basins, irrespective of the State boundaries. Why did you not choose to consider the total area of the sub-

basin (falling in all the co-basin States) for assessment of water availability as well as demands of water for various purposes?

b. Without going into the reliability and accuracy of the figures indicated in the Table on Page 15 or Table 13 on page 65 of your Affidavit (Vol. 208), we find that the overall demand for water is more than the availability of water. Obviously, all the identified demands cannot be fully met. How do you plan to address such a situation, particularly with reference to prioritization of different projected demands, keeping in view the provisions

of the National Water Policy 2012 and / or State Water Policies?

Ans. I will answer this question in two parts:

a. My study was basically to study the demands of each sub-basin. The in-basin demands of Karnataka were 1.857 TMC and that of Maharashtra were 3.53 TMC, as envisaged in their respective, Statements of Claim. I tried to find out sub-basin wise details, which I could not find in the documents. Hence, I restricted myself to the in-basin demands of the State of Goa itself.

b. The demands in Goa itself being more than 75% dependable flow in the river Mahadayi, confirms that the basin is deficient. National Water Policy 2012 recommends sensitization of the demands within a basin and it should be the need of the hour that the aforesaid National Policy is followed in letter and spirit and any water is not diverted outside the basin. The prioritization of meeting

the demand should be as per the National Water Policy 2012.

If demand is more than the available water, we may have to drop some of the hydro- power schemes."

1274.

The suggestion of Shri Nadkarni that " if demand is more than the available water, we may have to drop some of the hydro- power schemes" is irrelevant as the use of water for hydropower development is non-consumptive in nature.

1275.

From the discussion made above, it is apparent that the studies of Shri Subrai T. Nadkarni are lop-sided without taking into consideration all essential factors. In view of ever increasing demand of water for various purposes and by different stakeholders, it is necessary to examine all the aspects and undertake in-depth scientific evaluation of the issue of prioritization of various uses of water. This is more so when the water availability is found to be less than the demand, which is the case of the State of Goa, in respect of Mahadayi river basin. However, it is noticed by the Tribunal that, no such evaluation has been undertaken by Shri Nadkarni, as is apparent from his reply to question No. 14 put by the Tribunal. The question No. 14 and the reply thereof are reproduced hereunder.

“Q.No.14. Have you undert aken in-depth scientific evaluation of the issue of prioritization of various uses of water with due consideration to social, economical and environmental aspects, and particularly in the context of prioritization among in-basin uses and

utilizations through extra basin diversions? If such in-depth scientific evaluation has been undertaken, what are the findings thereof?

Ans. The in-depth scientific evaluation of prioritization has not been undertaken by me but the prioritization

will be followed as per the National Water Policy 2012 or any other policy in force at the relevant time. ”

[Emphasis supplied]

From above, it is apparent that the contents of the Report of Shri Nadkarni cannot be relied upon.

1276. In reply to question No. 6, put to Shri Nadkarni by the Tribunal, he informed the Tribunal that the State of Goa intends to meet the demands for major uses through the 61 projects identified by Panel of Experts. The question No. 6 and the reply thereof, are reproduced hereunder.

“Q.No.6. We find that your Affidavit dated 14.11.2017 (Vol. 208) includes the demand for various sub-basins. However, you have not indicated the names of the identified projects / schemes for meeting the identified demands as was done by the Panel of Experts, constituted by the State of Goa. We feel that the identification of projects / schemes is necessary because, only then, it will be possible to assess the “utilizable water” out of the “available water”.

Please tell us the names of the various projects/schemes identified by you and the quantum of utilizable water through such projects/schemes.

Ans. The State of Goa intends to meet the demands for major uses through the 61 projects identified by Panel of Experts. However,in case of some of the demands, it is not possible to prepare the DPRs, such as,

environment demands, tourism demands, etc.

However, attempts are being made to identify more projects, especially like abandoned mining pits, construction of bandharas, etc. for fulfilling the demands."

[Emphasis supplied]

Detailed Project Reports (DPRs) Filed by the State of Goa

1277.

As indicated in Para 1240 above, the State of Goa has submitted the detailed project reports (DPRs) of 59 proposed projects, out of 61 projects, listed in the Report of the Panel of Experts. The remaining two projects, namely, Anjunem and Amthane projects are the existing projects. Important features of the 61 projects are summarized in the Annexure 1-1, Annexure 2-1 and Annexure 2-2 of the "Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the State of Karnataka on 24/01/2014" (Volume 103).

1278.

From examination of the detailed project reports

(DPRs) of the 59 projects filed by the State of Goa, it is found by the Tribunal that, none of the DPRs have been prepared in accordance with the “Guidelines for Preparation of Detailed Project Report of the Irrigation and Multipurpose Projects”

2530

(MARK-5). Specific aspects required to be included in the detailed project reports (DPRs) and to be checked are clearly specified in Section I – Check List at pages 1 to 17 of the "Guidelines for Prepara tion of Detailed Project Report of the Irrigation and Multipurpose Projects" (MARK -5) under major heads namely, (i) General Data, (ii) Planning, (iii) Interstate and International Aspects, (iv) Surveys, (v) Geological Investigations, (vi) Seismic Investigations, (vii) Foundation Investigations, (viii) Construction

Meteorological

Material

Surveys,

(x)

(ix)

Hydrological

(xi)

and

Land

Investigations,

Hydrology,

Acquisition and Resettlement of Oustees, (xii) Designs, (xiii) Irrigation and Command Area Development, (xiv) Flood Control and Drainage, (xv) Navigation, (xvi) Power, (xvii) Construction Programme and Plant and Manpower Planning, (xviii) Foreign Exchange, (xix) Financial Resources, (xx) Estimate, (xxi) Revenue, (xxii) B. C. Ratio, (xxiii) Ecological Aspects, (xxiv) Colonies and Buildings, (xxv) Public Participation and Cooperation, and (xxvi) Soil Conservation.

1279.

It is found that even the basic informations relating to General Layout/Plan showing the project location, the catchment area up to the project site and the command area, are not

included in as many as 30 detailed project reports (DPRs) namely, (i) Sonal [Volume 103(a)], (ii) Khadki weir [Volume 103(c)], (iii) Shelpi [Volume 103(d)], (iv) Bimbal [Volume 103(f)], (v) Ganje weir [Volume 103(g)], (vi) Ganjem [Volume 103(h)], (vii) Usgao [Volume 103(i)], (viii) Mandovi Nanoda [Volume 103(j)], (ix) Nandran – I [Volume 103(y)], (x) Jamboli [Volume 103(z)], (xi) Udalshem [Volume 103(ae)], (xii) Kumbharwada [Volume 103(af)], (xiii) Shivde [Volume 103(ag)], (xiv) Paikul [Volume 103(ah)], (xv) Melavali [Volume 103(ai)], (xvi) Sonawali – I [Volume 103(aj)], (xvii) Sonawali – II [Volume 103(ak)], (xviii) Karanzol [Volume 103(am)], (xix) Khandepar [Volume 103(an)], (xx) Ghatakwada [Volume 103(ao)], (xxi) Nayawada [Volume 103(ap)], (xxii) Kharamol [Volume 103(ar)], (xxiii) Kharmol – II [Volume 103(as)], (xxiv) Matujanwada [Volume 103(at)], (xxv) Kajumol [Volume 103(au)], (xxvi) Suktoli [Volume 103(av)], (xxvii) Tatodi [Volume 103(aw)], (xxviii) Nirankal [Volume 103(ax)], (xxix) Kodar [Volume 103(az)], and (xxx) Advalpal [Volume 103(bb)].

1280.

Further, the Tribunal finds that, there is no indication about location of the projects i.e., longitude and latitude of the project sites in respect of as many as 24 projects, in the DPRs

filed by the State of Goa. 24 projects whose longitude and latitude are not indicated in the respective DPRs are (i) Sonal [Volume 103(a)], (ii) Khadki weir [Volume 103(c)], (iii) Bimbal I [Volume 103(f)], (iv) Ganje weir [Volume 103(b)], (v) Ganjem [Volume 103(h)], (vi) Usgao [Volume 103(i)], (vii) Nandran – I [Volume 103(y)], (viii) Jamboli [Volume 103(z)], (ix) Udalshem [Volume 103(ae)], (x) Kumbharwada [Volume 103(af)], (xi) Shivde [Volume 103(ag)], (xii) Paikul [Volume 103(ah)], (xiii) Melavali [Volume 103(ai)], (xiv) Sonawali – I [Volume 103(aj)], (xv) Sonawali – II [Volume 103(ak)], (xvi) Ghatakwada [Volume 103(ao)], (xvii) Nayawada [Volume 103(ap)], (xviii) Kharmol – II [Volume 103(as)], (xix) Matujanwada [Volume 103(at)], (xx) Kajumol [Volume 103(au)], (xxi) Suktoli [Volume 103(av)], (xxii) Tatodi [Volume 103(aw)], (xxiii) Kodar [Volume 103(az)], and (xxiv) Advalpal [Volume 103(bb)].

1281.

However, the Tribunal has examined and analysed, whatever little information is made available through the DPRs filed by the State of Goa. Some of the important facts emerging

out of the data / information provided in the DPRs are as under.

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a. As per information in Annexure 1-1, Annexure 2-1 and Annexure 2-2 of the “Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the Sta te of Karnataka on 24/01/2014” (Volume 103), the water requirements for irrigation through 59 proposed projects and 2 existing projects are 616.98 Mcum, against the projected demand of 2050 Mcum for irrigation by the State of Goa indicated in Para 189, p age 239 of “Amended Statement of Case of the State of Goa filed before the Mahadayi Water Disputes Tribunal” (Volume 131). The irrigation requirements mentioned at Annexure – 18, page 125 of the “Master Plan for Madei / Mandovi River Basin, Volume II”, pr epared by the Panel of Experts is 855.16 Mcum.

b. As per information in Annexure 1-1, Annexure 2-1 and Annexure 2-2 of the “Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the State of Karnataka on 24/01/2014” (Volume 103), the demand for water supply, through 59 proposed

projects and 2 existing projects, is 97.26 Mcum against the projected demand of 208 Mcum for water supply by the State of Goa indicated in

Para 189, on page 239 of

“Amended Statement of Case of the State of Goa, filed before the Mahadayi Water Disputes Tribunal” (Volume 131). The requirement for domestic water supply mentioned at Annexure – 18, page 125 of the “Master Plan for Madei / Mandovi River Basin, Volume II”, prepared by the Panel of Experts is 458.48 Mcum. On the other hand, Shri Nadkarni has indicated the requirement for domestic water supply including that for livestock as 41.36 Mcum in Table 12, on page 64 of his Affidavit (Volume 208). In addition, Shri Nadkarni has also indicated the water requirement for tourism as 23.07 Mcum.

c. The industrial water requirements have not been indicated in the in Annexure 1-1, Annexure 2-1 and Annexure 2-2 of the “Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the State of Karnataka on 24/01/2014” (Volume 103), although 208 Mcum has been indicated as the demand for industrial water use, by the State of Goa in Para 189, on page 239 of “Amended Statement of Case of the State of Goa filed

before the Maha dayi Water Disputes Tribunal” (Volume 131), on the basis of recommendations of the Panel of Experts. The requirement for industrial water has also not

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been indicated at Annexure – 18, page 125 of the “Master Plan for Madei / Mandovi River Basin, Volume II” , prepared by the Panel of Experts. Shri Nadkarni has indicated the water needs for industries as 96.42 Mcum at Table 12, page 64 of his Affidavit (Volume 208).

These differences in figures of water requirements are neither noticed by Shri Nadkarni nor explained, by the State of Goa.

1282.

Some other facts emerging from the analysis of the data included in the DPRs of 59 projects filed by the State of Goa and summarized in Annexure 1-1, pages 9-11 of the “Affidavit in answer submitted on behalf of State of Goa to the interrogatories administered by the State of Karnataka on 24/01/2014” (Volume 103) are as under.

a. The information about the catchment area and / or the water availability at 75% dependability in respect of three projects, namely, Khadki weir, Ganjim weir and Ganjem are not indicated in the Annexure 1-1. Total water availability

at 75% dependability in respect of remaining 56 projects is

3431.22 Mcum with total catchment area of 1094.87 sq.km. For limited purpose of comparison, the average value of water availability at 75% dependability has been computed by the Tribunal by dividing the total water availability of 3431.22 Mcum with the total catchment area of 1094.87 sq.km. which works out to be 3.134 Mcum/sq.km. i.e., 3134 mm/sq.km.

b. The project wise water availability at 75% dependability has also been computed by the Tribunal in mm/sq.km. from the value of water availability at 75% dependability indicated in 4 th column and the catchment area indicated in the 3 rd column of Annexure 1-1 of Volume 103 and the same is indicated in the following Table.

Sl. No.	Name of the Project	Catchment Area (Col. 3 of Annexure 1- 1 of Vol. 103)	75% Dependable Yield (Mcum) (Col. 4 of Annexure 1- 1 of Vol. 103)	75% Dependable Yield in mm per sq.km. (i.e., Col. 4*1000 /Col.3)
1	2	3	4	5

1	Kodal	15.90	35.54	2235
2	Sonal	2.09	5.93	2837

3	Sonal-I	426.00	1407.03	3303
4	Sonal-II	33.85	75.67	2235
5	Shelpi	11.50	30.77	2676
6	Gavane	2.32	6.16	2655
7	Bimbal	11.13	31.20	2803
8	Usgao	2.29	6.12	2672
9	Surla-II	24.80	94.37	3805
10	Surla-III	30.20	114.92	3805
11	Derode-I	75.20	265.00	3524
12	Derode-II	6.60	21.75	3295
13	Mandovi	119.06	302.62	2542
14	Iverekhurd	1.51	4.00	2649

15	Charawane	4.36	11.61	2663
16	Goleli	8.86	25.00	2822
17	Thane	6.68	18.20	2725
18	Dongurwada	6.97	20.00	2869
19	Thane-I	2.26	6.23	2757
20	Naneli-I	6.66	19.00	2853
21	Pali	1.02	3.00	2941
22	Naneli-II	2.65	7.00	2642
23	Zarme	5.97	16.50	2764
24	Ragada-I	18.06	59.00	3267
25	Ragada-II	5.58	15.00	2688
26	Nandran	8.90	22.00	2472

27	Avardo	14.55	39.00	2680
28	Nandran-I	6.44	18.26	2835
29	Jamboli	3.38	9.60	2840
30	Satpal	7.61	25.00	3285
31	Fatiyagal	5.19	14.28	2751
32	Ragada-III	26.06	87.00	3338
33	Udalshem	3.81	10.82	2840
34	Kumbarwada	2.83	8.04	2841
35	Shivde	4.97	14.11	2839
36	Paikul	4.05	11.50	2840
37	Melavali	4.31	12.22	2835
38	Sonawali-I	4.85	17.33	3573

39	Sonawali-II	9.06	32.36	3572
40	Mayda	15.05	51.18	3401
41	Karanzol	5.60	19.42	3468
42	Khandepar	37.54	149.36	3979
43	Ghatkawada	2.50	8.67	3468
44	Nayawada	2.26	7.84	3469
45	Dongurli	3.50	12.00	3429
46	Kharamol	32.85	70.11	2134
47	Kharamol-II	2.42	8.39	3467
48	Matujanwada	3.55	12.36	3482
49	Kajumol	18.03	60.07	3332
50	Suktoli	2.92	10.13	3469

51	Tatodi	7.08	24.55	3468
52	Nirankal	6.22	21.57	3468
53	Ponsule	2.23	7.73	3466
54	Kodar	2.55	8.82	3459
55	Keri	5.29	15.00	2836
56	Advalpal	7.75	20.88	2694

It is found that the same varies from 3979 mm/sq.km. in respect of the proposed Khandepar Project to 2134 mm/sq.km. in respect of Kharamol Project.

1283.

It is noticed by the Tribunal that, Shri Chetan Pandit, the Expert Witness of the State of Goa, in his “Affidavit of Examination-in- Chief of Shri Chetan Pandit” (Volume 191) has indicated the water availability at 75% dependability for the entire catchment of 2032 sq.km. as 4372.4 Mcum i.e., 2152 mm/sq.km. Against this value of 2152 mm/sq.km., the average

value of the water availability at 75% dependability in respect of the 56 projects as worked out by the Tribunal, is found to be about 3134 mm/sq.km. [indicated in Para 1282(a) above], which is relatively very high.

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1284.

Further, Shri Chetan Pandit has also assessed the water availability at 75% dependability in respect of 9 proposed project sites in Karnataka in the upper reaches of the Mahadayi river basin. The results as given in Table 1 Summary of Results, page 4- 5 of the “Additional Affidavit of Examination -in-Chief of Shri Chetan Pandit” (Volume 196) is reproduced in columns 1 to 3 of the Table-2 as under. The water availability at 75% dependability in mm/sq.km. has been computed by the Tribunal and the same is given in column 4 of the Table-2.

Table-2: Water Availability for Various Proposed Projects in Karnataka

Project	Catchment Area (in sq.km.)	Water Availability at 75% Dependability (in tmc)	Water availability at 75% Dependability (in mm / sq.km.) computed by the Tribunal
1	2	3	4

Kotni dam (independent catchment)	93.19	6.5881	2003
Bhandura dam	32.25	1.4961	1314

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Bail nadi	32.33	1.7667	1548
Kalasa (including Haltara and Surla diversions)	25.50	1.9767	2196
Irti diversions	8.78	0.3968	1280
Irti pickup dam	9.91	0.8089	2312
Katla-Palna diversion	22.50	1.5174	1910
Diggi diversion	15.6	1.0521	1911
Viranjole diversion	9.50	0.7320	2183

1285.

It is further found by the Tribunal that, as per the assessment made by Shri Chetan Pandit, the water availability at 75% dependability in upper reaches in the State of Karnataka is far less than the water availability at 75% dependability at various proposed project sites in the State of Goa.

1286.

In this regard, the Tribunal has noted that, the learned Senior Counsel for the State of Goa during his arguments on 8.2.2018 [Ref: page 16, Volume 237 filed on 21.2.2018] stated as under.

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“30. The State of Goa submits that, each of these 12 proposed projects / dams are in the core-catchment area of Mahadayi River and Basin which has a mountainous topography and that all 12 proposed projects are on top of the mountain, where the precipitation / rainfall is the highest whichcan be evidenced through the dense forests in the area. If all the said 12 projects are allowed to be set up in the core-catchment area it will have disastrous environmental consequences in the entire Mahadayi River basin.”

[Emphasis supplied]

1287.

The facts emerging from the results in respect of assessment of water availability at 75% dependability by Shri Pandit in respect of the projects in Karnataka in upper reaches and that indicated in the DPRs for the projects in Goa do not corroborate the above quoted statement of the leaned Senior Counsel for the State of Goa.

1288.

From the foregoing discussion, it is apparent that the assessment of water requirements for various purposes in the Mahadayi river basin by the State of Goa are not made with due consideration to all the aspects. The detailed project reports (DPRs) prepared and filed in respect of 59 projects are not in accordance with the “Guidelines for Preparation of Detailed

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Project Report of the Irrigation and Multipurpose P rojects”

(MARK-5).

1289.

Further, the State of Goa has failed to establish

through scientific studies that any diversion of water outside the basin would adversely impact: (a) the water resources including ground water resources; (b) river morphology; (c) agriculture; (d) irrigation; and (e) navigation, etc.

1290.

Similarly, the State of Goa has not established

conclusively through scientific studies that the impact of climate change and global warming would adversely impact the water resources of Mahadayi river basin and consequently impact all related issues such as, river morphology, agriculture, irrigation, and navigation, etc.

1291.

The Tribunal finds that the profile in respect of the

identified 59 project sites, presented through detailed project reports (although, cannot be considered as the “detailed project

reports”), particularly in respect of availability of water at the project sites, availability of utilizable water etc. and the projected utilization for various purposes are, apparently, not based on

proper field investigations and requisite studies. However, the Tribunal feels that the identification of 59 project sites for development of water resources of Mahadayi river basin in Goa and preparation of general features of these projects by the State of Goa, is a step in the positive direction.

1292.

In the absence of any other reliable action plan, the Tribunal permits the State of Goa to go ahead with: (a) undertaking proper investigations and studies; (b) preparing the detailed project reports (DPRs); (c) seeking clearances from central agencies; (d) obtaining all mandatory clearances from the competent authorities; and (e) implementing the projects for maximum consumptive utilization (including drinking water requirements for both human beings and livestock, municipal water needs, irrigation water requirements and industrial water demands) of 668 Mcum (24 tmc) of water of Mahadayi river basin at 75% dependability through aforementioned 59 identified projects. The Tribunal does not wish to put any restriction on non-consumptive use of water of Mahadayi river

basin through the identified 59 projects including that for hydropower generation. Needless to say that the permission of the Tribunal to the State of Goa to plan for utilization of 24 tmc

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of water at 75% dependability, is over and above the existing utilization of 9.395 tmc.

1293.

The permission to the State of Goa to plan and utilize a maximum of 24 tmc of water at 75% dependability, as in-basin needs would be subject to:

a. Re-assessment of availability of water at 75% dependability and assessment of the utilizable water at the aforementioned 59 sites after duly accounting for the environmental flow in accordance with “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA

Notification 2006” of the Ministry of Environment, Forest and Climate Change published in April 2015 (MARK-37);

b. Technical appraisal of the detailed project report (DPR) of each of the aforementioned 59 projects by the Central Agencies; and

c. Mandatory clearances for each of the aforementioned 59 projects by the competent authorities.

DECISIONS ON ISSUES FRAMED FOR DETERMINATION

Issues Related to Data Availability and Quality of Data

1294.

Issue Nos. 1, 4, 6, 15, and 54 relate to aspects of availability, quality and adequacy of hydro-meteorological, hydrological and other data necessarily required for assessment of water availability. All related aspects have been examined and addressed in detail in the various paras on the subject of 'Hydrology and Water Availability" and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issues Related to Hydrological Analysis and Methodology for Assessment of Water Availability

1295.

Issue Nos. 9, 24, and 41 relate to aspects of hydrological analysis and methodology for assessment of water availability. All related aspects have been examined and addressed in detail in the various paras on the subject of 'Hydrology and Water Availability" and there is no need of

examining all related issues separately. These issues stand answered accordingly.

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Issues Related to Dependability for Assessment of Water Availability

1296.

Issue Nos. 7, 8, 10, 33, 34, 35, 36, 37, 53, 55, and 56 relate to aspects of dependability at which the water availability should be determined. All related aspects have been examined and addressed in detail in the various paras on the subject of ‘Hydrology and Water Availability” and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issues Related to Water Utilization for Various Purposes, Projected Demand of Water by the Respective States, and their Allocations

1297.

Issue Nos. 12, 13, 14, 17, 28, 29, 40, 42, 43, 44, 45, 46, 47, 49, 57, and 58 relate to aspects of water utilization for various purposes and projected demand of water by the three party States, namely Goa, Karnataka and Maharashtra, and their allocations. All related aspects have been examined and

addressed in detail in the various paras on the subjects of ‘Demand of Mahadayi Water by the State of Karnataka’, ‘Demand of Mahadayi Water by the State of Maharashtra’ and ‘Demand of

Mahadayi Water by the State of Goa' and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issues Related to (a) Ecology, Global Warming and its Impact, and (b) Adverse Impact of Development of Water Resources on Ecology etc.

1298.

Issue Nos. 5, 11, 16, 18, 19, 21, 22, 23, 30, 32, and 60 relate to aspects of ecology, global warming and its impact on water resources, adverse impact of development of water resources on ecology etc. All related aspects have been examined and addressed in detail in the various paras on the subject of 'Ecology' and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issues Related to Navigation

1299.

Issue Nos. 3, 20, and 50 relate to navigation on river Mahadayi. All related aspects have been examined and addressed in detail in the various paras on the subject of

‘Navigation’ and there is no need of examining all related issues separately. These issues stand answered accordingly.

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Issues Related to Effect of Deletion of Para 28(iv) and 28(v) from Pleadings of the State of Goa

1300.

All aspects of Issue Nos. 38 and 39 have been examined and addressed in detail in the various paras on the subject of 'Effect of Deletion of Para 28(iv) and 28(v) from Pleadings of the State of Goa' and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issues Related to Need for Prior Consent of Co-basin States for Undertaking Projects / including Projects for Diversions outside Mahadayi Basin

1301.

Issue Nos. 2, 25, 26, 31, 48 and 59 relate to various aspects which are directly or indirectly mentioned with reference to the need for prior consent of co-basin States for undertaking projects, including projects for diversions outside Mahadayi Basin. These aspects are also examined with reference to the provisions of the Forest (Conservation) Act, 1980 and the

Wild Life (Protection) Act. All related aspects have been examined and addressed in detail under the respective sections

and there is no need of examining all related issues separately. These issues stand answered accordingly.

Issue Related to Sharing of the Water and Benefits out of the Water Allocated for Utilization Outside the Basin

1302.

Issue Nos. 51, 52, 62 and 63 relate to sharing of water and benefits out of the water allocated for utilization outside the basin and related matters. These issues framed in view of specific pleadings of the State of Maharashtra and examined hereunder.

1303.

The issue No. 51 is as under.

“51. Whether the determination of share of Maharashtra State or any other co-basin State as a result of augmentation of waters in Krishna basin (due to transfer of water from river Mahadayi) should be undertaken while examining the claims of co-basin States?”

This Issue was framed in view of the specific pleadings of the State of Maharashtra at para 5.1.5 to para 5.2.2 which are

reproduced hereunder.

“5.1.5 TheKrishna Water Dispute Tribunal, while making the equitable distribution of Krishna Basin waters amongst Maharashtra, Karnataka and Andhra Pradesh, has held that any water diverted from other river to augment supplies in the Krishna basin would be legal and the other riparian states would be entitled to the proportionate share of such augmentation. (Annexed hereto and marked **Annexure16** isthe copy of the said part of the Report)

5.1.6 TheGodavari Water Dispute Tribunal has permitted the Andhra Pradesh to divert water from river Godavari near Polavaram Project to Krishna Delta Project of Andhra Pradesh to an extent of 80 TMC. By an agreement, the Maharashtra and Karnataka have been permitted to have an additional share of 14 TMC and 21 TMC respectively in their allocated share of Krishna Basin Waters. (Annexed hereto and marked **Annexure 17** isthe copy of the said part of the Report)

Share of Maharashtra State in Krishna Basin due to

proposed diversion of Karnataka.

5.2.1 TheKrishna Water Dispute Tribunal as stated herein above have upheld the legality of transbasin diversion of waters and right of riparian states to have it's proportionate additional share in the event of augmentation of supplies to the basin. In the light of these provisions the action of State of Karnataka in diverting waters of Mahadayi/ Mandovi Basin to Malprabha River in Krishna Basin will entitle the State of Maharashtra to have additional share in the allocated water of Krishna Basin.

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5.2.2 ThisHon'ble Tribunal is requested to determine and grant the additional share of Maharashtra in Krishna Basin from the proposed diversion of 7.56 TMC by the State of Karnataka from the water of Mahadayi / Mando vi River to Malprabha River in Krishna Basin."

However, it is found by the Tribunal that this aspect has not at all been addressed by the State of Maharashtra either by leading any evidence or through the arguments by the learned Counsel for the State of Maharashtra. It is also found that the subject matter of the Issue has not been addressed by the State of Goa or by the State of Karnataka either by leading any evidence or through the arguments by the learned Counsel.

The Tribunal is of the firm view that the matter i.e., sharing of water of Krishna basin, which has been raised by the State of Maharashtra, is beyond the purview of the Mahadayi Water Disputes Tribunal.

Keeping in view the above position, the Issue No. 51 is answered in negative.

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1304.

Issue Nos. 52, 62 and 63 are as under.

“52. Whether the State of Maharashtra or any other State would be entitled to have share from the additional power that would be generated by the State of Karnataka as a result of augmentation of waters in the Kali basin due to diversion of water to Kali Hydro Power Project?”

“62. Whether the State of Maharashtra proves that the State of Karnataka is not justified in diverting waters of the inter-State river Mahadayi and its valley to the Kali river for augmenting the generation of electricity under the existing Kali Hydro Power Project?

63. Whether the State of Maharashtra proves that its share of power should be determined on the basis of the additional power that would be generated by the State of Karnataka as a result of augmentation in the Kali basin due to diversion of waters to Kali Hydro Power Project?”

These Issues was framed in view of the specific pleadings of the State of Maharashtra at para 5.3.1 to para 5.3.3 which are reproduced hereunder.

“Diversion of water from Mahadayi/Mandovi basin to Kali Basin

5.3.1 TheState of Karnataka vide it’s letter No. WRD/08/KDM/2009 Dt. 22nd June, 2010 has submitted the letter of complaint under section 3 of the Interstate Water Disputes Act, 1956, read with Interstate Water Dispute Rules 1959, to the Ministry Of Water Resources, Govt. of India. While dealing with specific matters in dispute the State of Karnataka has requested this Hon. Tribunal to consider whether, the State of Karnataka would be justified in diverting waters of the interstate rive r Mahadayi (Mandovi) and it’s valley to the Kali River for augmenting the generation of electricity under the existing Kali Hydro Power Project and If so, what extent of diversion is just and reasonable? The map accompanying the letter of complaint reveals the proposal of State of Karnataka for diversion of waters to Kali Basin from Viranjole Diversion Scheme, Katla and Palna Diversion Schemes and Digi Diversion Scheme to

Kali Basin. At present the entire proposal of diversion of waters from Mahadayi / Mandovi Basin to Kali Basin has not been disclosed by the State of Karnataka.

5.3.2 Asstated hereinabove the Krishna Water Dispute Tribunal has upheld the diversion of water outside the basin as legal and has also held the right of riparian States to claim additional share. In the present case, by the proposed action of the State of Karnataka the diversion of Mahadayi/Mandovi River water through various schemes to Kali Basin results in augmentation of supplies to Kali Hydro Electric Project (outside Mahadayi Basin) of the State of Karnataka and thereby results in

additional production of the power by the State of Karnataka.

5.3.3 Itis submitted that on the principle enumerated above the other riparian States are entitled for a share in the power generated by Karnatka. Therefore the State of Maharashtra requests this Hon'ble Tribunal to adjudicate and grant a share in the power to the State of Goa and the State of Maharashtra due to proposed diversion from Mahadayi/Mandovi Basin to Kali Basin."

However, it is found by the Tribunal that these aspect have not at all been addressed by the State of Maharashtra either by leading any evidence or through the arguments by the learned Counsel for the State of Maharashtra. It is also found that the subject matter of the Issue has not been addressed by the State of Goa or by the State of Karnataka either by leading any evidence or through the arguments by the learned Counsel. Further, it is noted by the Tribunal that the proposal of the State of Karnataka for diversion of water of Mahadayi basin to Kali Hydro Power Project has not been found as acceptable one.

This makes the suggestion of the State of Maharashtra through Issue Nos. 52 and 62 as redundant.

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Keeping in view the above position, the Issue Nos. 52, 62 and 63 are answered in negative

Issues relating to Adverse Impact of the Proposed Projects of the State of Karnataka on the proposed Projects of State of Maharashtra

1305.

Issue Nos. 60 and 61 relate to adverse impact of the proposed Kalasa-Bhandura Projects of the State of Karnataka on the proposed projects of the State of Maharashtra.

1306.

The issue Nos. 60 and 61 are as under.

“60. Whether the State of Maharashtra proves that the diversion of water of Haltara nalla by the State of Karnataka through construction of dam on Haltara would adversely affect the flows in Haltara Nalla particularly in the post monsoon season and more so in summer season and that this would jeopardise water supplies to the inhabitants of Virdi village and would sound death knell for the flora and fauna, survival of

which is dependent on the waters of nalla.

61. Whether the State of Maharashtra proves that the State of Karnataka is not entitled to execute the Kalasa-Bhanduri project (Drinking Water Project) and divert 7.56 tmc of water as claimed by it every years of the inter-State river Mahadayi to the Malaprabha river in

the Krishna basin to the prejudice of the existing and contemplated projects of Maharashtra, including the Virdi (Morachi Rai) project?"

These Issues were framed in view of the specific pleadings of the State of Maharashtra at para 3.4 (B) and para 3.4 (C) and relief sought at para (ea) which are reproduced hereunder.

"3.4 (B) Inhabitantsof village Virdi in Maharashtra have historically been and are presently dependent on the perennial flows of Haltara Nalla for meeting their water needs. Similarly the flora and fauna in that area are also dependent on the flows of Haltara Nalla for their survival.

3.4 (C) Thecatchment area of Haltara nalla in the State of Karnataka almost entirely contributes to the flows in the nalla near village Virdi. Major catchment area in Karnataka is proposed to be dammed and diverted by Karnataka near village Chorla. Such a diversion would cut off flows from substantial contributing catchment area and therefore would adversely affect the flows in

Haltara Nalla particularly in the post monsoon season and more so in summer season. This would jeopardise water supplies to the inhabitants of Virdi village and would sound death knell for the flora and fauna, survival of which is dependent on the waters of nalla. Halatara nalla flowing through the States of Karnataka, Maharashtra and Goa, and its catchment areas are shown on the map marked as **Annexure-21** .”

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“RELIEFS SOUGHT BY THE STATE OF MAHARASHTRA

…

(ea) That in the event of trans-basin diversion being allowed to the State of Karnataka, this Hon'ble Tribunal may be pleased to direct the State of Karnataka to maintain minimum flows in Haltara nalla in the post monsoon period so that the sustenance of the inhabitants, flora and fauna in the State of Maharashtra is not jeopardised.

…”

However, it is found by the Tribunal that this aspect has not at all been addressed by the State of Maharashtra either by leading any evidence or through the arguments by the learned Counsel for the State of Maharashtra. It is also found that the subject matter of the Issue has not been addressed by the State of Goa or by the State of Karnataka either by leading any evidence or through the arguments by the learned Counsel. Keeping in view the above position, the Issue Nos. 60 and 61 are answered in negative

2559

Issues Relating to Over-the Year Storages / Carry Over Storages by the Upper Riparian State and Timely Releases from the Projects

1307.

The issue Nos. 27, 66 and 67 are as under.

" 27. Whether the State of Goa establishes that specific restraints or restriction be placed on the upstream riparian States with regard to construction and regulation of their projects, during each water year for beneficially using their allocated equitable share of Mandovi river basin waters?"

"66. Whether the upper riparian States can construct over-the-year storages / carry over storages?

67. Whether there should be clear directions for timely and periodic releases from projects in upper reaches to enable the lower riparian State to realize its allocations or designed success rate of its projects, without affecting success rate of the projects / allocation of the upper riparian States? "

The Tribunal finds that the learned Counsel for the State of Maharashtra has addressed Issue Nos. 66 and 67 along with six other issues in the Argument Notes filed by him on 15.1.2018

(Volume 221). Relevant extract from the Argument Notes are reproduced hereunder.

“The State of Maharashtra submits that in the present dispute the in-basin utilization so far has reached around 10 tmc i.e., about 5% of the water availability. The State of Maharashtra has only one ongoing minor irrigation project with planned utilization of 0.5 tmc water. Only when this Hon’ble Tribunal de cides the allocation of the water to different party States, the planning of projects, in real sense will be taken up by the States. As far as State of Maharashtra is concerned, considering the topography of the terrain, the nature of the projects would be either in the category of minor irrigation projects or at the most, large minor irrigation projects. Further, Maharashtra State is of the opinion that none of the States have led any evidence on these issues. Therefore, in the present circumstances, it would be premature to put any restriction on any State.

The State of Maharashtra, therefore, prays that all the

six issues may be answered in the negative .”

[Emphasis supplied]

The Tribunal finds that the arguments of the leaned Counsel of the State of Maharashtra in respect specific Issue Nos. 66 and 67 are rather vague. However, the State of Maharashtra has prayed that the issues be answered in negative.

The Tribunal also finds that this aspect has been examined by Shri Chetan Pandit (AW1) in his Additional Affidavit filed on 12.9.2016 (Volume 192). Relevant extracts from the Additional Affidavit of Shri Pandit are reproduced hereunder.

“118. As regards, the capacity of the storages in the upstream, the storages should have capacity only to meet the "during the year" requirement of each project. Providing carry over storage for the next year creates a potential for the upstream State to store and use excess water over and about their allotted share, thereby causing distress to the downstream State.

Another consideration is that as the storage capacity increases, the submergence area and the number of people displaced also increases. While submergence and displacement is not very welcome anywhere, it is particularly unwelcome in the Western Ghats which are identified as areas with very rich bio-diversity. Any storage will cause some harm to the bio-diversity and the objective should be to minimize the damage.

119. For the above reasons, in my opinion there should not be any water conservation over and above the allocated shares of the States."

These issues have not been specifically addressed by the State of Karnataka. Neither the State of Karnataka has led any

evidence to substantiate its claim, nor did the learned Counsel for the State of Karnataka argue on this subject.

Keeping in view all related aspects, the above issues stand answered in negative.

Issues Relating to Project-wise Restrictions on Storages etc.

1308.

The issue Nos. 64 and 65 are as under.

" 64. Whether project-wise restrictions should be placed on the storages and utilization of waters of river Mahadayi?"

"65. Whether storages of projects of upper riparian States should be determined to meet their allocation?"

The aforesaid issues were framed in view of the specific pleadings of the State of Goa. In its letter No. 68-4/CE-WRD-EO-2002-03/208 dated 9.7.2002 addressed to the Secretary, Union Ministry of Water Resources, New Delhi, (pages 5-28, Volume 1), the Government of Goa, inter-alia, had requested to adjudicate and decide specific restraints or restrictions to be placed on the upstream States with regard to construction and regulation of

their projects, during each water year for beneficially using their allocated equitable share of the Mandovi river basin waters. The aspect is also described in detail, in the para 224 of the Statement of Case filed by the State of Goa (Volume 131). Relevant portion is extracted hereunder.

"… It is submitted that after this Hon'ble Tribunal gives their award and places project wise restrictions on the storages & utilization of waters of river Mahadayi …"

In support of the above, Shri Chetan Pandit (AW-1) in his Affidavit filed on 12.9.2016 (Volume 192) has stated as under.

" 113. In any basin, a downstream State is placed in a geographically disadvantageous position and is at the mercy of the upstream state for release of water. Mahadayi basin is a special case because of its encompassing four wild life sanctuaries and one bird sanctuary, and generally being in the eco-sensitive zone of very rich bio-diversity. Therefore, it is not sufficient to be allotted a certain total quantity of water on an annual basis. It is equally important to get the said water at

specified times when it is required for irrigation etc. and also to get it at specific locations.

Not only the main river Mahadayi, but some of its tributaries also, originate in the State of Karnataka or Maharashtra and flow down to the State of Goa. Projects for consumption of water for irrigation, drinking water,

industrial use are located on all these branches / tributaries. A downstream state is concerned about getting its share not only in the basin as a whole but also in each of the inter-state tributaries, and at specified times. For this reason, in the event and if at all, the Tribunal is pleased to permit any project on this interstate river, then, it is essential that the Award may give detailed instructions regarding the quantity of water to be used by the upstream State not only in each project but also at various periods of time.

114. It is also necessary to give instructions to the upstream State for timely release of water to the downstream State for human consumption and also for the environment flow.

115. It is also necessary that the water sharing formulae be spelt out for three scenarios namely

(a) Normal year,

(b) Wet Year and

(c) Dry year.

116. Whether the year as a whole is normal / wet / dry will be known only at the end of the Monsoon season. But the water withdrawal and release decisions have to be taken throughout the year at regular intervals. Therefore, it is also necessary that the Award may contain detailed instructions on how to measure the inflow and at what locations, at what times, thereby to periodically assess whether the Monsoon is progressing as normal/wet / dry year.

Whatever rainfall is to occur in a year, it is not uniformly distributed over all the monsoon months. It is quite possible that the year starts in one way but then the rains may withdraw or increase and the complexion of the year as Normal / Wet / Dry may change. Therefore, detailed instructions are necessary to the upstream States as to how, where and when to observe the flow and how to assess the year and thereby take water management decisions.

117. Detailed instructions are also necessary to the upstream States about the procedures for water accounting, to determine without any ambiguity how much water is available and how much has been used by who, at various times.

118. As regards, the capacity of the storages in the upstream, the storages should have capacity only to meet the "during the year" requirement of each project. Providing carry over storage for the next year creates a potential for the upstream State to store and use excess

water over and about their allotted share, thereby causing distress to the downstream State. Another consideration is that as the storage capacity increases, the submergence area and the number of people displaced also increases. While submergence and displacement is not very welcome anywhere, it is particularly unwelcome in the Western Ghats which are identified as areas with very rich bio-diversity. Any storage will cause some harm to the bio-diversity and the objective should be to minimize the damage. ”

It is found by the Tribunal that the aforesaid aspect has not been addressed by the State of Maharashtra or by the State of Karnataka by leading any evidence. However, The Tribunal finds that the learned Counsel for the State of Maharashtra has addressed this specific issue along with six other issues in the Argument Notes filed by him on 15.1.2018 (Volume 221). Relevant extract from the Argument Notes are reproduced hereunder.

“The State of Maharashtra submits that in the present dispute the in-basin utilization so far has reached around 10 TMC i.e., about 5% of the water availability. The State of Maharashtra has only one ongoing minor irrigation project with planned utilization of 0.5 TMC water. Only when this Hon’ble Tr ibunal decides the allocation of the water to different party States, the planning of projects, in real sense will be taken up by the States. As far as State of Maharashtra is concerned, considering the topography of the terrain, the nature of the projects would be either in the category of

minor irrigation projects or at the most, large minor irrigation projects. Further, Maharashtra State is of the opinion that none of the States have led any evidence on these issues. Therefore, in the present circumstances, it would be premature to put any restriction on any State.

2567

The State of Maharashtra, therefore, prays that all the six issues may be answered in the negative .”

[Emphasis supplied]

The Tribunal finds that the arguments of the leaned Counsel of the State of Maharashtra in respect of specific issues are rather vague and not at all relevant.

The issues are answered in favour of the State of Goa. The Tribunal has examined all the projects proposals of the respective States keeping in view all the related aspects/matters. The issues relating to (i) utilization of specific quantum of water at the project sites, (ii) schedule for the storage / diversion of water, and (iii) releases of environmental flows downstream of the project sites, etc. have accordingly been examined and appropriate findings and direction recorded.

2568

NEED FOR AUTHORITY/BOARD FOR INTEGRATED PLANNING AND MANAGEMENT OF WATER RESOURCES OF MAHADAYI BASIN

Issues framed for Determination

1309.

On 17 th July 2015, on the suggestions of the party States, following two Issues (No. 68 and 69) were included in the revised list of issues while recasting the issues for determination by the Mahadayi Water Disputes Tribunal; which are re-produced as under:

" Issue No.68 :Whether any scheme may be framed for conservation of water over and above the allocated shares of the States by constructing reservoirs wherever possible which may be regulated by a regulatory authority for the benefit of the three riparian States wherever there may be any shortfall?

Issue No.69 :Whether any machinery should be set up to make available and regulate allocation of water to the States concerned or otherwise to implement the

decision?”

1310.

The Tribunal finds that response to the issues

to be

regarding any machinery or Regulatory Authority

constituted, is given only by Shri Chetan Pandit, expert witness

for the State of Goa, in his Additional Affidavit, filed on 12.09.2016 in paragraphs 121 to 125 (volume 192). He is the only witness who has made suggestions relating to the formation of a management board or authority, for implementation of report/award/final decision to be rendered by the Mahadayi Water Disputes Tribunal. The Tribunal further finds that neither the State of Karnataka, nor the State of Maharashtra, have either in their pleadings or through the evidence of witnesses examined by them, have indicated suggestions for constitution of a Management Board/ Authority for implementation of final decision made by Mahadayi Water Disputes Tribunal, at all. When specific issues have been framed as to whether any scheme should be framed for conservation of water, over and above the allocated shares of the States by constructing reservoirs, wherever possible, which may be regulated by a Regulatory Authority, for the benefit of the riparian States, and when a specific issue has been framed as to whether any machinery should be set up to make available and regulate allocation of water to the States concerned, or otherwise to

implement the decision, this Tribunal expected the State of Karnataka and the State of Maharashtra to respond. It is noted by the Tribunal that the learned Counsel for the State of

2570

Karnataka did not mention these issues in his written submission nor during oral arguments. The learned Counsel for the State of Maharashtra has listed these two issues along with four other issues under “Common Issues” on page 66 of the ‘Argument Notes by the State of Mahara shtra’ (Volume 221). In this regard, the learned Counsel for the State of Maharashtra has made following submission.

“The State of Maharashtra submits that in the present dispute, the in-basin utilization so far has reached around 10 TMC i.e. about 5% of the water availability. The State of Maharashtra has only one ongoing minor irrigation project with planed utilization of 0.5 TMC water. Only when this Hon’ble Tribunal decides the allocations of water to different party States, the planning of projects, in real sense will be taken up by the States. As far as the State of Maharashtra is concerned, considering the topography of the terrain, the nature of the projects would be either in the category of minor irrigation projects or at the most,

large minor irrigation projects. Further Maharashtra State is of the opinion that none of the States have led any evidence on these issues. Therefore, in the present circumstances, it would be pre-mature to put any restrictions on any States.

The State of Maharashtra, therefore, prays that all the six issues may be answered in the negative.”

2571

Obviously, the response of the State of Maharashtra is not based on facts since the State of Goa has duly examined Shri Chetan Pandit as a witness on these issues. However, the Tribunal finds that no response has been received either from the State of Karnataka, or the State of Maharashtra, as to whether any machinery should be set up to make available and regulate allocation of water to the States concerned or otherwise to implement the decision. Probably such an attitude may indicate that those two States are not interested in the constitution of a Management Board/ Authority for implementation of the Report/ Final Decision rendered by the Tribunal. Such a recalcitrant, disobedient, obstinate, unwilling and indifferent attitude by the State of Karnataka and the State of Maharashtra can hardly be approved by the Tribunal.

1311.

Recently a three Judge Bench of the Hon'ble Supreme Court of India, has interpreted, Section 6A of the Inter-State River Water Disputes Act, 1956, in the case of the State of Karnataka Vs. State of Tamil Nadu & Ors., reported in (2018) 4 SCC 1. After

quoting the provisions of Section 6A of the said Act, the Hon’ble Supreme Court of India has held in para 444 - 445 as under:

"4 44. We have already noted the submissions of the learned Solicitor General. His submission, in essentiality, is that the Court should not issue any direction to the Central Government and allow the discretion to be exercised by it as the provision uses the word may. The said argument, as we perceive on a first blush, may look quite attractive or for a while impressive but really cannot stand the substance test. In ***Stateof Karnataka*** (supra) while interpreting the said provision in the context of maintainability, we had held:-

"…The learned Senior Counsel for the respondent has drawn a distinction between the conferment and the exclusion of the power of the Supreme Court of India by the original Constitution and any exclusion by the constitutional amendment. Be that as it may, the said aspect need not be adverted to, as we are only required to interpret Section 6(2) as it exists today on the statute book. The said provision has been inserted to provide teeth to the

decision of the Tribunal after its publication in the Official Gazette by the Central Government and this has been done keeping in view the Sarkaria Commission‘s Report on Centre -State Relations (1980). The relevant extract of the Sarkaria Commission‘s Report reads as follows:

“17.4.19. The Act was a mended in 1980 and Section 6-A was inserted. This section provides for framing a scheme for giving effect to a Tribunal‘s award. The scheme, inter alia provides for the establishment of the authority, its term of office and other conditions of service, etc. But the mere creation of such an agency will not be able

to ensure implementation of a Tribunal‘s award. Any agency set up under Section 6-A cannot really function without the cooperation of the States concerned. Further, to make a Tribunal‘s award binding and effectively enforceable, it should have the same force and sanction behind it as an order or decree of the Supreme Court. We recommend that the Act should be suitably amended for this purpose.

***

17.6.05. The Inter-State Water Disputes Act, 1956 shoul d be amended so that a Tribunal’ s award has the same force and sanction behind it as an order or decree of the Supreme Court to make a Tribunal ’ s award really binding. ”‖

74. The Report of the Commission as the language would suggest, was to make the final decision of the Tribunal binding on both the States and once it is treated as a decree of this Court, then it has the

binding effect. It was suggested to make the award effectively enforceable. The language employed in Section 6(2) suggests that the decision of the Tribunal shall have the same force as the order or decree of this Court. There is a distinction between having the same force as an order or decree of this Court and passing of a decree by this Court after due adjudication. Parliament has intentionally used the words from which it can be construed that a legal fiction is meant to serve the purpose for which the fiction has been created and not intended to travel beyond it. The purpose is to have the binding effect of the Tribunal ' s award and the effectiveness of enforceability. Thus, it has to be narrowly

construed regard being had to the purpose it is meant to serve. ”‖

445. We have referred to the aforesaid passages as the award of the Tribunal has to be treated as decree of the Supreme Court. It is so stated in Section 6(2) to give teeth to the award passed by the Tribunal so that none of the States can raise objection to the same and be guided by the directions of the Tribunal. The purpose of framing the scheme is exclusively for implementation of the award. The authorities cited by Mr. Ranjit Kumar, we are afraid, are of no assistance in the present context. It needs no special emphasis to state that the purpose of Section 6A is to act in the manner in which the award determines the allocation and decides the dispute with regard to allocation or sharing of water. Keeping that in view, we direct that a scheme shall be framed by the Central Government within a span of six weeks from today so that the authorities under the scheme can see to it that the present decision which has

modified the award passed by the Tribunal is smoothly made functional and the rights of the States as determined by us are appositely carried out. When we say so, we also categorically convey that the need based monthly release has to be respected. It is hereby made clear that no extension shall be granted for framing of the scheme on any ground.

…"

1312.

In view of what is ruled by the Hon'ble Supreme Court of India, this Tribunal is of the firm opinion that once the Central

2575

Government is directed to constitute a Water Management Board or Water Management Authority, the Central Government has no option, but to constitute such Authority or Board.

1313.

The Tribunal finds that the power conferred on the Central Government under section 6A of the Act is coupled with duty and, therefore, the word ‘may’ appearing in Section 6A of the Act will have to be construed as meaning ‘shall’. If above interpretation is not adopted, the whole exercise of – (i) consulting the Hon’ble Ch ief Justice of India to nominate a sitting Judge of the Supreme Court of India to act as the Chairman of the Tribunal and to recommend names of two sitting Judges of the High Courts, who shall act as Members of the Tribunal; (ii) the constitution of Water Disputes Tribunal by the Central Government; (iii) allotment of premises to the Tribunal; (iv) appointment of Assessors by the Central Government to advise the Tribunal on the matters relating to disputes between two or more States; (v) appointment of the staff; (vi) directions by the Tribunal to the party-States to file their respective claims, replies,

rejoinders; (vii) engaging of Senior lawyers by the States concerned for advancing their respective cases and paying them hefty fees for arguing the case; (viii) recording of the evidence of

2576

the witnesses by the Tribunal; (ix) hearing the arguments advanced by the learned Senior counsel for the States concerned, over months together; (x) salary paid to the staff; (xi) making of Award by the Tribunal etc., would become an exercise in futility and not only the precious time of all concerned, including that of Central Government, but expenditure incurred by the three party-States and Central Government, would also go in vain. Further, the decision, which is treated to be a decree passed by the Hon'ble Supreme Court of India, would remain a paper decree and effective and meaningful implementation of the Report and Final Decision would become impossible unless and until the suggestion made by the Tribunal to constitute a Management Board is implemented by the Central Government. Therefore, the Tribunal expresses a strong view that the Central Government has no option but to form a Management Board or Authority for the purpose of implementing the Award that may be passed by an Inter-State Water Disputes Tribunal.

1314.

It is worth noticing that the present reference, before

this Tribunal, referred to by the Central Government u/s 4 of the Inter-State River Water Disputes Act, 1956, is virtually a suit, and but for the enactment of the said Act by the Parliament, in

exercise of powers conferred by Article 262 of the Constitution, such disputes would have been normally resolved, by an ordinary Civil Court, having jurisdiction in the matter. However, Section 6(1) of the Inter-State River Water Disputes Act, 1956, inter alia, provides that once the decision of the Tribunal is published in the official Gazette, the decision shall be final and binding on the parties to the dispute and shall be given effect to, by them. Sub-section (2) of Section 6 of the said Act further provides that the decision of the Tribunal, after its publication in the official gazette by the Central Government under sub-section (1), shall have the same force as an order or decree of the Supreme Court.

1315.

A conjoint and meaningful reading of the provisions of Section 6 read with Section 6A of the Act, makes it evident that it is the duty of the Central Government to frame a scheme to give effect to the decision of the Tribunal, as suggested / recommended, by the Tribunal. A machinery, for the implementation of the Award of the Tribunal relating to Inter-State River, is most essential component, in the resolution of the

Inter-State River disputes. In fact, so critical is this issue, that the success or failure of the Award, rendered by a statutory Tribunal, depends primarily, on the successful operation of the said

2578

Machinery, which, in turn, depends on choosing a correct model for the said Machinery. Therefore, the Mahadayi Water Disputes Tribunal proposes to strongly recommend to the Central Government to form an Authority called ‘Mahadayi Water Management Authority’ (the ‘Authority’, for short), for implementation of its Report and Final Decision rendered, adjudicating the water disputes subsisting between the three party-States.

1316.

Initially, no machinery was provided under the Act for implementation of the decision or orders passed by the Tribunal. The Narmada Water Disputes Tribunal realizing that there may be controversy in respect of implementation of its decision, and with the consent of party States gaveseveral directions (Narmada Water Disputes Tribunal Report Volume No. II, Chapter XX, pages 152-158) and ordered to setting up of machinery for implementing the decision of the Tribunal namely, Narmada Control Authority. This had led to need of modifying the Inter-state Water dispute Act, 1956 by the Central Government.

Accordingly, the Act was modified in 1980 as detailed below.

2579

Modified Inter-State River Water Disputes Act, 1956

1317.

The Inter-State River Water Disputes Act, 1956 was modified in 1980 and a new Section 6A was introduced in the said Act, by Act 45 of 1980 with effect from 27.8.1980 for giving effect to the decisions of a Tribunal. The Section 6A is as follows:

“6 A. (1) Without prejudice to the provisions of Section 6, the Central Government may, by notification in the Official Gazette, frame a scheme or schemes whereby provision may be made for all matters necessary to give effect to the decision of a Tribunal.

(2) A Scheme framed under sub-section (1) may provide for:

(a) the establishment of any authority (whether described as such or as a committee or other body) for the implementation of the decision or directions of the Tribunal;

(b) the composition, jurisdiction, powers and functions of the authority, term of office and

other conditions of service, the procedure to be follow-by and the manner of filling vacancies among the members of the authority;

(c) the holding of a minimum number of meetings of the authority every year, the quorum for such meetings and the procedure there at;

(d) the appointment of any standing, ad hoc or other committees by the authority;

(e) the employment of a Secretary and other staff by the authority, the pay and allowances and other conditions of service of such staff;

(f) the constitution of a fund by the authority, the amounts that may be credited to such fund and the expenses to which the fund may be applied;

(g) the form and the manner in which accounts shall be kept by the authority;

(h) the submission of an annual report by the authority of its activities;

(i) the decisions of the authority which shall be subject to review;

(j) the constitution of a committee for making such review and the procedure to be followed by such committee; and

(k) any other matter which may be necessary or proper for the effective implementation of the decision or directions of the Tribunal.

(3) In making provision in any scheme framed under

sub-section (1) for the establishment of an authority for giving effect to the decision of a Tribunal; the Central Government may, having regard to the nature of the jurisdiction, powers and functions required to be vested in such authority in accordance with such decision and all other relevant circumstances, declare in the said scheme that such authority shall, under the name specified in the said scheme, have capacity to acquire, hold and dispose of property, enter into contacts, sue and be sued and do all such acts as may be necessary for the proper exercise and discharge of its jurisdiction, powers and functions.

(4) A scheme may empower the authority to make, with the previous approval of the Central Government,

2581

regulation for giving effect to the purpose of the scheme.

(5) The Central Government may, by notification in the Official Gazette, add to, amend, or vary, any scheme framed under sub-section (1).

(6) Every scheme framed under this section shall have effect notwithstanding anything contained in any law for the time being in force (other than this act) or any instrument having effect by virtue of any law other than this Act."

1318.

The Tribunal has examined the matter having regards to the following aspects:

i.

How such issues were addressed by various Tribunals in the past?

ii.

What are provisions of Inter-State River Water Disputes Act, 1956? and

iii.

What are the activities essentially required to be performed by the Authority?

1319.

Before making recommendation to form an Authority, for implementation of the Report/Final Decision, this Tribunal has taken into consideration the recommendations made by Shri Chetan Pandit as well as recommendations made in the judgments of the Hon’ble Supreme Court of India and those

included in the final decisions, rendered by different Water Disputes Tribunals. They are as under:

Recommendations made by Shri Chetan Pandit

1320.

Shri Chetan Pandit in his Additional Affidavit (Vol.192) pleaded that a machinery for implementation of the Inter-State agreement or the Tribunal Award is a most essential component in the resolution of interstate dispute. He has stated that the success or failure of such agreement/ award depends primarily on the successful operation of the aforesaid mechanism, which in turn, depends upon choosing a correct model for the said machinery, typically called a River Board or Authority. He has also raised the points (i) whether such Board should be an autonomous body or a subordinate office of the Union Ministry of Water Resources and (ii) the Board should have own cadre or the staff may be appointed on deputation.

1321.

He has further pointed out that, where the projects are owned and operated by the State Government wherein these

are located and the Management Board merely issues instructions to the concerned State for release of water in a

particular manner, there is a possibility that upper riparian State may not comply with the directions of the Management Board. Shri Pandit asserts that, in case of Cauvery River, despite of an interim award given by the Tribunal for release of water to the lower riparian State, the upper riparian party State did not comply with directions given by Cauvery Water Disputes Tribunal and the lower riparian State has often rushed to Hon'ble Supreme Court for implementation of the decision. He has also pointed out that the operation of any water resources structure, whether it is a dam or barrage, requires considerable technical knowledge of the electro-mechanical equipment and the personnel of the Board may not have the necessary knowledge to operate such equipment.

Finally, he has stated that a Management Board in line of Bhakra Beas Management Board (BBMB) and Tungabhadra Board for operation of Tungabhadra Dam may be an answer to such difficulties [paragraph 131 of Additional Affidavit of Examination-in-chief of Shri Chetan Pandit, dated 12.09.2016 (Volume 192)].

1324.

Besides the above, Shri Chetan Pandit in Para 113 of his Additional Affidavit (Vol. 192) has also stated that in an Inter-State River Basin, a lower riparian State is always placed in a

geographically dis-advantageous position and at the mercy of the upper riparian State for release of water, and more so, to get the said water at specified time when it is required for irrigation etc. and also to get at specific location. Therefore, according to him, the State of Goa being the lower riparian State in Mahadayi River Basin would be concerned about securing its share not only in the basin as a whole but also in each of its tributaries at specified time. Therefore, he has suggested that the Tribunal should give detailed instructions regarding the quantity of water to be used by the State of Karnataka not only in each project but also at various points of time.

Shri Chetan Pandit has also

pleaded in Para 115 of his Additional Affidavit that the water sharing formula may be spelt out in all the situations viz. (a) normal year (b) wet year and (c) dry year. In the para 118 (Volume 192), Shri Chetan Pandit has also touched upon the issue of the storage capacities to be built by the upper riparian States, to meet the water requirement in a year only or should the upper riparian State cannot carry over storage to store and

use excess water over and above their allocated share.

1325.

The State of Karnataka has not pleaded or argued,

either in favour or otherwise, on the issue of constitution of the

2585

Management Board/ Authority for Mahadayi River Basin in final written submissions of the case. The State of Maharashtra in its written submission has opined that the issue should be answered in negative.

Narmada Control Authority

1326.

The Narmada Water Disputes Tribunal submitted its award as “Final Order and Decision of the Tribunal” on December 12, 1979. In the final order, there are sixteen clauses, and Clause XIV relates to ‘Setting up of Machinery for Implementing the Decision of the Tribunal’. The relevant extract of the Clause XIV of Narmada Water Disputes Tribunal is reproduced below:

“Clause XIV: - Setting up of Machinery for Implementing the Decision of the Tribunal.

We make the following orders with regard to setting up of machinery for implementing the decision of the Tribunal:-

Sub-clause 1:

Constitution of the Authority.

1(1): An Inter-State, administrative authority to be called Narmada Control Authority (hereinafter referred to as the ‘Authority’) shall be establishe d for the purpose of securing compliance with and implementation of the decision and directions of the Narmada Water Disputes Tribunal (hereinafter referred as the ‘Orders’).

1(2): The Authority shall consist of seven high-ranking Engineer Members of whom one each shall be of the rank of Engineer-in-Chief, Chief Engineer, or Additional Chief Engineer of the Irrigation Department, Power Department or the State Electricity Board appointed by the Government of each of the States of Madhya Pradesh, Gujarat, Maharashtra and Rajasthan and three other eminent Engineers of a rank not less than that of a Chief Engineer to be appointed by the Central Government in consultation with the party States. One of the three Independent Members shall be nominated by the Central Government, as the Chairman of the

Authority with a deliberative vote at meetings where decisions are taken on any matter affecting the interest of more than one State and he will be in charge of the administrative work of the Authority. The Central or State Government, as the case may be, shall have the power to remove or suspend from the Authority any Member who, in its opinion, is not suitable to continue as Member.

1(3): Each Independent Member shall be a full-time Member and be appointed for a term not exceeding five years. The Members appointed by the State Government shall be part-time Members. The

appointing authority for Independent Member or that for part-time Member, as the case may be, shall determine the terms and conditions of appointment in each case. As far as practicable, the first appointment of the seven members of the Authority shall be made within three months from the date of publication of the decision of the Tribunal in the Official Gazette.

…

Sub-clause 2 – Secretary of the Authority

The Authority shall employ a Secretary, who shall be an Engineer. He shall not be a Member of the Authority.

Sub-clause 3 – Quorum And Voting:

Five Members shall be quorum and the concurrence of the majority shall be necessary for the transaction of the business of the Authority except such business as the Authority may from time to time prescribe as routine. The Authority shall not prescribe as routine any business in which the interest of any two of the States are likely to be in conflict. For the transaction of routine business

three Members shall be a quorum and in the absence of the Chairman of the Authority, the Chairman elected at the meeting shall have a deliberative vote and in the event of an equality of votes a casting vote also. Subject as aforesaid the members shall have equal powers.

Sub-clause 4 – Disposal Of Business By The Authority

4(1): Subject to the provisions of Sub-clause 4(2) below, the Authority may dispose of any matter before it either by circulation or by holding a meeting.

However, it will be open to any Member of the Authority to require that a matter shall not be disposed of by circulation but at a meeting.

4(2): On the following matters the Authority shall record its decision by a Resolution at a meeting in which the Chairman and all the Members from the party States are present:

(i) Framing of Rules of Business;

(ii) Delegation of functions to a Member or Secretary or any official of the Authority;

(iii) Categorising any part of the business of the Authority as a formal or routine nature;

(iv) Any other matter which any of the four party States require that it shall be decided at a meeting where all the members from the party States are present.

However, if any particular item under this Sub-clause cannot be disposed of at two successive meetings owing to the absence of one or more Members from the party

States, it shall be disposed of under Sub-clause 3 of Clause XIV.

4(3): Subject to the foregoing provisions, the Authority shall frame its own Rules for the conduct of its business.

4(4): The Authority shall cause proper minutes or records of all its proceedings to be kept as a permanent record.

…

Sub-clause - 8: Powers, Functions & Duties of the Authority

8(1): The role of the Authority will mainly comprise coordination and directions. Normally all bilateral matters should be deal with mutually by the States concerned and referred to the Authority only if there is a dispute.

8(2): The Authority shall be charged with the power and shall be under a duty to do any or all things necessary, sufficient and expedient for the implementation of the Orders with respect to:

(i) the storages, apportionment, regulation and control of the Narmada waters;

(ii) sharing of power benefits from Sardar Sarovar Project;

(iii) regulated releases by Madhya Pradesh;

(iv) acquisition by the concerned State for Sardar Sarovar project of lands and properties likely to be submerged under Sardar Sarovar;

(v) compensation and rehabilitation and settlement of oustees; and

(vi) sharing of costs.

…

Sub-clause 13 – Decision of the Authority

The decisions of the Authority on all matters covered under Sub-clause 8 shall be final and binding on the four party States. However, there shall be a Review Committee which may suo moto or on the application of any party State review any decision of the Authority. In urgent cases the Chairman of the Review Committee may, on the application of the party State, grant stay of any order of the Authority pending final decision on review.

Sub-clause 14 - Review Committee

2590

14(1): The Review Committee shall consist of five members including a Chairman as under:-

(i) Union Minister for Irrigation : Chairman

(ii) Chief Minister of Madhya Pradesh : Member

(iii) Chief Minister of Gujarat : Member

(iv) Chief Minister of Maharashtra : Member

(v) Chief Minister of Rajasthan : Member

The Secretary of the Union Ministry of Agriculture and Irrigation, Department of Irrigation shall be the Convener of the Review Committee but shall not have any voting right. In case there is President's Rule in any of the States, the Governor of that State or his authorized representative will act as Member of the Review Committee."

Cauvery River Authority (CRA)

1327.

When the Cauvery Water Disputes Tribunal had issued an interim order dated June 25, 1991, the Central Government issued a Notification No. S.O. 675 (E) dated 11.08.1998 to give

effect to the interim order issued by the Tribunal, for constituting the Cauvery River Authority, in exercise of the powers conferred by sub-section (1) of Section 6A of the ISWDT Act, 1956 as stated below:

“2. CONSTITUTION OF THE CAUVERY RIVER AUTHORITY

2591

(1) There shall be an Authority under this scheme to be known as the Cauvery River Authority (hereinafter referred to as the Authority).

(2) The Authority shall consist of the following:

(a) Prime Minister of India -Chairperson

(b) Chief Minister of Karnataka -Member

(c) Chief Minister of Kerala -Member

(d) Chief Minister of Tamil Nadu -Member

(e) Chief Minister of Pondicherry -Member

(3)

POWERS AND FUNCTIONS OF THE AUTHORITY:

- Therole of the Authority shall be to give effect to the implementation of the interim order dated 25 th June 1991 of the Tribunal and all its related subsequent orders.
- TheAuthority shall frame rules and regulations for the conduct of its business.
- TheAuthority may convene meetings as and when necessary.

(4)

CAUVERY MONITORING COMMITTEE

Under the Authority, there shall be a Monitoring Committee with the following composition:

(a) Secretary-in-charge of the Ministry of Central Government dealing with water resource - Chairman,

(b) The Chief Secretaries to the Governments of Karnataka, Kerala, Tamil Nadu and Union Territory of Pondicherry – Member

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(c)

Chairman, Central Water Commission – Member

(d) One officer each, not below the rank of Chief Engineer, to represent the State of Karnataka, Kerala and Tamil Nadu and the Union Territory of Pondicherry to be nominated by the respective State Governments or the Union Territory Commission – Members

(e) Chief Engineer, Central Water Commission – Member-Secretary

(5) ROLE AND FUNCTIONS OF THE MONITORY COMMITTEE:

a. The role of the Monitoring Committee will be to render assistance to the Authority to enable it to take decisions on issues under consideration.

b. The Monitoring Committee shall assist the Authority in collecting information and data.

c. The Monitoring Committee shall assist the Authority in monitoring the implementation of the decisions of the Authority. In case, any difficulty

arises in implementation, the Monitoring Committee shall report the position to the Authority.

d. The Monitoring Committee shall assist the Authority in setting up a well-designed hydro meteorological network in Cauvery basin along with a modern communication system for transmission of data and a computer based control room for data processing to determine the hydrological conditions.

2593

Cauvery Management Board

1328.

While issuing its final award, the Cauvery Water Disputes Tribunal issued final order in 2007, wherein a Machinery for implementation of Final Decision/ Orders was suggested in Chapter 8 of the Volume V of the Report. In Para 2 of the Chapter 8, the Tribunal stated as under.

“From the records, it appears that from time to time, the parties to the dispute especially, the State of Tamil Nadu had to approach the Supreme Court for a direction against the State of Karnataka to comply with the interim order passed by this Tribunal fixing a schedule for release of water in different months of the year. It also appear that on most of the occasions, the State of Karnataka came up with the plea that because of the insufficient rainfall during the period concerned, it had not been possible for them to comply with the interim order strictly by releasing the quantity of water as directed.”

1329.

The Cauvery Water Disputes Tribunal, in its order further mentioned that, the State of Tamil Nadu had urged the Tribunal that it should constitute an Authority having the power to monitor on day to day basis, the different reservoir in the States of Kerala, Karnataka and Tamil Nadu and to give

appropriate directions in respect of the implementation of the decision of this Tribunal so far the share of the different riparian States are concerned. After the introduction of Section 6A of ISWDT Act, the situation has changed. Section 6A (1) in clear and unambiguous words says:

“6A(1) without prejudice to the provisions of section 6, the Central Government may, by notification in the Official Gazette, frame a scheme or schemes whereby provision may be made for all matters necessary to give effect to the decision of a Tribunal.”

1330.

In view of the above, the Cauvery Water Disputes Tribunal suggested that an Inter-State forum to be called ‘Cauvery Management Board’ shall be established for the purpose of securing compliance and implementation of the final decision and directions of the Cauvery Water Disputes Tribunal. The Board shall be under the control of the Government of India, Ministry of Water Resources. The composition of the Cauvery Management Board shall be as under:

1. The Cauvery Management Board shall consist of a whole time Chairman and two whole time Members to be appointed by the Central Government. The post of whole

time Chairman shall be held by an Irrigation Engineer of repute of the rank of Chief Engineer having not less than 20 years' experience in the field of water resources management.

2. One whole time Member shall be an Irrigation Engineer of not below the rank of Chief Engineer having sufficient field experience in the operation of the reservoirs and management, maintenance and operation of large irrigation projects for a period of not less than 15 years.

3. The second whole time Member shall be an agriculture expert of repute especially in Agronomy with a field experience of 15 years.

4. Two representatives of the Central Government shall be of the rank of Chief Engineer/ Commissioner to be nominated by the Ministry of Water Resources and Ministry of Agriculture respectively. They shall be part time Members of the Board.

5. A representative each of the State Governments of Kerala, Karnataka, Tamil Nadu and Union Territory of Pondicherry

2596

shall be nominated by the respective Governments, they shall be part time Members of the Board. The State representative shall again be an Irrigation Engineer of the rank of Chief Engineer, Irrigation/ Water Resources/ Public Works Department as the case may be, nominated by the respective State Government.

Cauvery Water Regulatory Committee

1331.

The Cauvery Management Board shall constitute a Committee known as 'Cauvery Water Regulatory Committee' with the following composition:

(1) Full Time Member Irrigation of the Board – Chairman

(2) One representative each of the States of Kerala, Karnataka, Tamil Nadu and Union Territory of Pondicherry not below the rank of a Superintending Engineer – Member

(3) One representative of IMD of the rank of Director – Member

(4) One representative of Central Water Commission dealing with river gauging not below the rank of Superintending

Engineer – Member

2597

(5) One representative of the Central Ministry of Agriculture not below the rank of Superintending Engineer – member

(6) Secretary to Cauvery Management Board – Member Secretary.

Functions of the Regulation Committee

1332. The Regulation Committee shall ensure the implementation of the provisions contained in the final order of the Cauvery Water Disputes Tribunal in accordance with the directions of the Board namely:

a. To collect daily water levels, inflows and storage position at each of the following reservoirs – Hemavathy, Harangi, Krishnarajasagara, Kabini, Mettur, Bhavani-sagar, Amaravathy and Banasurasagar.

b. To ensure ten daily releases of water on monthly basis from the reservoirs as directed by the Board.

c. To collect data of water released from the aforesaid reservoirs on 12 hourly basis.

d. The Board's representatives at each of the reservoirs shall monitor proper implementation of the regulation instruction issued by the Regulation Committee; in the event of any variation the representative shall immediately inform the Secretary of the Committee for appropriate action.

e. To collect daily water flows passing through presently identified inter-State contact point i.e. Billigundulu gauge

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f.

g.

h.

i.

discharge site and keep to give effect to the interim order issued by the Tribunal, the Board suitably informed.

To compile monthly water account for each reservoir.

To collect and compile weekly information about important rain gauge stations of the IMD in order to be able to broadly assess the position of monsoon and keep the Board informed about the status of the monsoon.

The State representative, in-charge of the major projects will keep the Regulation Committee regularly informed about the occurrence of the rainfall in the commands and whether any change in the releases is required.

To prepare seasonal and annual report of the water account and submit the same to the Board as indicated below:-

- South-Westmonsoon season: 1 st June to 15 th October,

- NorthEast Monsoon season: 16 th October- 31 st January,
- Hotweather season: 1 st February to 31 st May.

Establishment of Cauvery Water Management Authority

1333.

In pursuance to the Order of the Hon'ble Supreme Court, in the case of the State of Karnataka Vs. State of Tamil Nadu & Ors., reported in (2018) 4 SCC 1, the Government of India has established Cauvery Water Management Authority vide Gazette Notification dated 1 st June 2018 [Ref: S.O. 2236(E)]. Important features of the Cauvery Water Management Authority are reproduced hereunder.

“I. Establishment of Cauvery Water Management Authority

2. Constitution of the Authority — Thereshall be an Authority called as Cauvery Water Management Authority.

3. (1)The Authority shall be a body corporate having perpetual succession and a common seal and shall sue and be sued.

(2) The Authority shall consist of the following members, namely:

(a) Chairman - To be appointed by the Central Government, who shall have tenure of five years or till sixty-five years of age, whichever is earlier, amongst the serving officers, namely: - (i) who is a senior and eminent engineer with wide experience in water resource management handling of inter-State water sharing issues; construction, operation and maintenance of irrigation projects; or (ii) an All India Service Officer, in the rank of Secretary or Additional Secretary to the

Government of India with experience in water resources and inter-State water sharing issues;

(b) **Twowhole-time Members -** Tobe appointed by the Central Government for a term of three years which may be extendable upto five years, as mentioned below:

(i) One Member (Water Resources) – an engineer not below the rank of Chief Engineer from the Central Water Engineering Services (CWES) cadre;

(ii) One Member (Agriculture) – not below the rank of a Commissioner from the Ministry of Agriculture and Farmers' Welfare;

(c) **TwoPart-Time Members –** Representativesof the Central Government of the rank of Joint Secretary to be nominated by the Ministry of Water Resources, River

Development and Ganga Rejuvenation and Ministry of Agriculture and Farmers' Welfare respectively;

(d) **FourPart-Time Members from party States –** Administrative Secretaries in charge of Water Resource Departments of each State Government of Kerala, Karnataka, Tamil Nadu and Union territory of Puducherry who shall be nominated by the State Governments and Union territory administration respectively.

4. Secretary of the Authority. — TheAuthority shall have a Secretary who shall be an engineer to be appointed by the Central Government for a term of three years which may be extendable upto five years and not below the rank of Chief Engineer from the Central Water Engineering Services cadre and he shall not have any voting rights.

5. Quorum and voting. — (1)Six Members shall form a quorum and the concurrence of the majority shall be necessary for transaction of the business of the

Authority except such business as the Authority may from time to time prescribe as routine. The Members shall have equal powers.

(2) The next meeting will be held within three days if the meeting is postponed for want of quorum and for that meeting quorum will not be necessary.

6. Disposal of Business by the Authority. — (a)On the following matters, the Authority shall record its decision by a resolution at a meeting in which the Chairman and all the part-time Members from the party States are present: —

(i) framing of Rules of Business;

(ii) delegation of functions to a Member or Secretary or any official of the Authority;

(iii) categorizing any part of the business of the Authority as of a formal or routine nature;

(iv) any other matter which may be considered necessary by any of the part-time Members from party States that it shall be decided at a meeting of the Authority.

(b) Chairman of the Authority can invite representatives from Central Water Commission, National Institute of Hydrology, Indian Agricultural Research Institute (IARI) and any other agency including Universities as special invitees to attend the Authority meetings or otherwise, in carrying out the functions specified under this scheme.

(c) Subject to the foregoing provisions, the Authority shall frame its own rules for the conduct of its business.

7. Indemnity of Members. — NoMember, officer or employee of the Authority shall be liable for loss, injury

or damages resulting from:

(a) action taken by such Member, officer or employee in good faith and without malice under the apparent authority of the orders, even though such action is later determined to be unauthorised, or (b) the negligent or wrongful act of omission of any other person employed by the Authority and serving under such Member, officer or employee unless such Member, officer, or employee failed to exercise due care in the appointment of such other person or the supervision of his work.

8. Officers and servants of the Authority. — (1)The Authority may from time to time appoint or employ such and so many officers and employees as it thinks fit and remove or dismiss them, under the rules and

regulations applicable to the appointment, removal and dismissal of the Central Government officers and employees. All such officers and employees shall be subject to the sole control of the Authority. The Authority may, with the previous approval of the Central Government, make regulations to regulate conditions of service of all such officers and employees in respect of the residential accommodation, house rent allowance, travelling allowance, daily allowance, conveyance allowance and medical reimbursement. The scales of pay and the other service conditions shall be as applicable to the Central Government employees.

(2) The persons who are employed in the services of the said States and the Union territory of Puducherry may be appointed or employed by the Authority in such proportions as the Authority may deem fit. The Authority shall make arrangement with the State Government or the Union territory, as the case may be, to spare the services of the persons employed in the

State Government or the Union territory for whole-time employment with the Authority, or for the performance of any work or services for the Authority. The Authority may also appoint any personnel by direct recruitment or obtain the same from the Centre or other sources, as considered necessary.

9. Administrative and field organisation costs. — (1)All expenses of the Authority (including salary and other expenses of the Chairman, whole-time Members and Secretary) shall be borne by the concerned State Governments and the Union territory of Puducherry in the ratio of Kerala – 15%; Karnataka – 40%, Tamil Nadu – 40%; and Union territory of Puducherry – 5%. The expenses pertaining to Member representing a State or

Union territory shall be borne by the State or Union territory concerned.

(2) The cost of maintaining, operation and controlling of gauging and other hydrological systems for communicating data shall be borne by the State or Union territory concerned.

(3) The cost of construction and maintenance of the storages, power installations, diversion works, head-works and canal networks shall be borne wholly by the State Government or Union territory in whose territory the works are located.

10. Powers, functions and duties of the Authority. — (1) The Authority shall exercise such power and shall discharge such duty to do any or all things necessary, sufficient and expedient for securing compliance and implementation of the Award of the Tribunal as modified by the Hon'ble Supreme Court vide Order dated the 16th February, 2018 including:

(i) storage, apportionment, regulation and control of

Cauvery waters;

(ii) supervision of operation of reservoirs and with regulation of water releases therefrom with the assistance of Regulation Committee;

(iii) regulated release by Karnataka, at the inter-State contact point presently identified as Billigundulu gauge and discharge station, located on the common border of Karnataka and Tamil Nadu.

(2) The Authority may constitute one or more sub-committees and assign to them such of its functions and delegate such of its powers as it thinks fit.

(3) In particular and without prejudice to the generality of the foregoing functions, the Authority shall perform inter alia, the following functions, namely: -

(i) The Authority at the beginning of the water year, i.e. first June each year would determine the total residual storage in the specified reservoirs. As, it is not possible to know the amount of season-wise river flows which will be available during a season, it will be assumed that the inflows will be according to 50% dependable year (yield 740 TMC). The share of each State will be determined on the basis of the flows so assumed together with the available carry-over storage in the reservoirs. The withdrawals will be allowed during the first time interval of ten days of the season on the basis of the share worked out for each party State, limited to the water requirements during the same period indicated by each party State by placing an indent of water demand with Cauvery Water Regulation Committee.

(ii) The Authority will take stock of the actual yield in the basin at the end of the previous time interval as well as the utilization or releases and storage built up during

the interval and assess the trend of inflows and authorize withdrawals to the States for the subsequent time interval accordingly. For giving effect to the aforesaid provision, the Authority may have to repeat this exercise for two or more time intervals.

(iii) The Authority shall ensure the implementation of the Award of the Tribunal as modified by the Hon'ble Supreme Court vide Order dated 16th February, 2018 including the carry-over storage during good year and the water releases for environmental purposes. The Authority, through the Regulation Committee and with the help of Central Water Commission, and other Central or State organizations as necessary will identify situations of distress in the river basin. Distress caused

by diminution of water flows during the period will be shared by the party States after the distress conditions and their extent is determined by the Authority, keeping in view water shares allotted to parties.

(iv) The following important reservoirs in the river basin, namely, Banasurasagar in Kerala; Hemavathy, Harangi, Kabini and Krishnarajasagara in Karnataka; and Lower Bhavani, Amaravathy and Mettur in Tamil Nadu shall be operated in an integrated manner by the concerned State under the overall guidance of the Authority for each ten days period throughout the year to meet the seasonal water requirements of the party States for irrigation, hydro-power generation, domestic and industrial uses, etc. The remaining quantities of the surplus water shall be conserved as far as possible and spillage of water shall be reduced to the minimum.

(v) The Authority shall maintain an account of cropping pattern, area cropped and area irrigated for each party State. The Authority shall also maintain an account of

domestic and industrial water usage by each party State.

(vi) The Authority shall set up a well-designed communication network in the Cauvery basin for transmission of data and a computer based control room for data processing to determine the hydrological conditions including distress, if any. For this purpose, it may utilize the latest technology. For operational purposes, this work may be entrusted by the Authority to Central Water Commission or any other Central or State Government organization.

(vii) On the beginning of irrigation season which is 1st June of every year, all the party States through their representatives in the Authority shall submit an indent for the supplies required by them at each reservoir site

(capacity 3 TMC and above) for the month of June broken in ten daily intervals. The Authority will examine reasonableness of the indents keeping in view the cropping pattern and extent of area to be irrigated and order releases keeping in view the overall ceiling prescribed by the Tribunal and modified by the Hon'ble Supreme Court vide Order dated 16th February, 2018 for the month after determining the available carry-over storage and taking into consideration the likely inflows during the month. The Regulation Committee shall release water on ten daily bases as ordered by the Authority.

(viii) In case of deficiency in the water availability during any month as reported by the Regulation Committee, the Authority will consider reduction in the indent of the parties in proportion to the quantities allocated to each State by the Tribunal as modified by the Hon'ble Supreme Court vide Order dated 16th February, 2018 for the designated crops.

(ix) The Regulation Committee shall keep a watch on the actual performance of the monsoon during each ten daily interval and report position to the Authority indicating therein the extent of variation from the normal. The Authority on receipt of such information will consider any change in the release ordered by them earlier. Similar exercise will continue as the monsoon progresses during the succeeding months till the end of the water year which is 31st May of every year.

(x) The Authority shall ensure that the respective State Governments should construct proper hydraulic structures at all important anicut sites in the river basin with a provision of appropriate regulation mechanism. Besides, regular monitoring of the withdrawals at such

diversion structures on the part of the State would be necessary.

(xi) The Authority may direct party States to furnish data in respect of carry-over storage in reservoirs, including inflows and outflows, rainfall data, the area irrigated and water utilized.

(xii) The Authority shall arrange collection of data for important rain gauge stations maintained by Indian Metrological Department or Central Water Commission or States in the Cauvery basin, as also inflow data measured at important nodal points on the Cauvery river system through the Cauvery Regulation Committee which will suitably compile the rainfall data for different monsoon seasons along with the inflows measured at different sites.

(xiii) The Authority or any Member or any representative thereof shall have power to enter upon any land or property upon which any hydraulic structure or any work of gauging or measuring device has been or

is being constructed, operated or maintained by any agency in the Cauvery basin.

(xiv) The Authority shall have power to hold and dispose of property, enter into contracts, sue and be sued and do all such acts as may be necessary for the proper exercise and discharge of its jurisdiction, powers and functions.

(xv) The Authority may construct or make direction to construct additional gauging stations to the States concerned with the assistance of Central Government and Central Water Commission for implementing the decision of the Tribunal.

(xvi) If the Authority finds that any Government of the party States, namely Tamil Nadu, Kerala, Karnataka and

Union territory of Puducherry do not co-operate in implementing the decision or direction of the Tribunal, it can seek the help of the Central Government for implementation of the Award of the Tribunal as modified by the Hon'ble Supreme Court vide Order of 16th February, 2018.

(xvii) If any delay or shortfall is caused in release of water on account of default of any party State, the Authority shall take appropriate action to make good the deficiency by subsequently deducting indented releases of that party State.

(xviii) The Authority shall advise the party States to take suitable measures to improve water use efficiency, by way of promoting micro-irrigation (drip and sprinkler), change in cropping pattern, improved agronomic practices, system deficiency correction, command area development, etc.

(xix) The Authority shall advise the party States to adopt efficient technologies for water conservation and

preservation.

(xx) The Authority shall comply with the directions of the Central Government issued from time to time with respect to composition, establishment and administration of the Authority.

(xxi) The Authority may delegate such of its power, as it thinks fit, to Cauvery Water Regulation Committee.

11. Annual Report of the Authority. — TheAuthority shall prepare and transmit to each of the four party States as early as possible but not later than 30th September of each year, an Annual Report covering the activities of the Authority for the preceding year. The Authority shall make available to each party State on its request any information within its possession any time

and always provide access to its records to the party States and their authorized representatives.

12. Records of the Authority and their location. — (1) The Authority shall keep a record of its meetings and proceedings, maintain regular accounts, and have a suitable office where documents, records, accounts and gauging data shall be kept open for inspection by the Central Government and Government of each of the party States and Union territory or their representatives at such time and under such regulations as the Authority may determine.

(2) The Head Quarters of the Authority shall be at New Delhi.

II. Cauvery Water Regulation Committee

17. Composition of the Cauvery Water Regulation Committee. — (1)There shall be a Cauvery Water Regulation Committee consisting of the following members, namely:-

1) Whole-Time Member (Water Resources) of the

Authority - Chairman;

2) One representative each of the States of Kerala, Karnataka, Tamil Nadu and Union territory of Puducherry not below the rank of Chief Engineer. - Member;

3) One representative of India Meteorological Department, of the rank of Joint Secretary - Member;

4) One representative of Central Water Commission dealing with river gauging not below the rank of Chief Engineer - Member;

5) One representative of the Ministry of Agriculture & Farmers' Welfare, Government of India not below the rank of Commissioner - Member;

6) Secretary to the Authority - Member Secretary.

(2) The Head Quarters of the Cauvery Water Regulation Committee shall be at Bengaluru.

18. Functions of the Cauvery Water Regulation Committee. — TheCommittee shall ensure the implementation of the provisions contained in the final Award of the Tribunal as modified by th e Hon'ble Supreme Court vide Order dated the 16th February, 2018 with the directions to the Authority, namely: —

(a) to collect daily water levels, inflows and storage position at each of the following reservoirs – Hemavathy, Harangi, Krishnarajasagara, Kabini, Mettur, Bhavanisagar, Amaravathy and Banasurasagar;

(b) to ensure ten daily releases of water on monthly basis from the reservoirs as directed by the Authority;

(c) to collect data of water released from the aforesaid reservoirs on twelve hourly basis;

(d) the Authority's representatives at each of the reservoirs shall monitor proper implementation of the

regulation instruction issued by the Committee and in the event of any variation, the representative shall immediately inform the Member Secretary of the Committee for appropriate action;

(e) to collect daily water flows passing through presently identified inter- State contact point Billigundulu gauge and discharge site and keep the Authority suitably informed;

(f) to compile and reconcile monthly water account for each reservoir;

(g) to collect and compile weekly information about important rain gauge stations of the India Meteorological Department in order to be able to

broadly assess the position of monsoon and keep the Authority informed about the status of the monsoon;

(h) the State representative, in-charge of the major projects will keep the Committee regularly informed about the occurrence of the rainfall in the commands and whether any change in the releases is required;

(i) to prepare seasonal and annual report of the water account and submit the same to the Authority as indicated below: —

(a) South-West monsoon season (inclusive of fortnight of October)

— 1st June to 15th October;

(b) North-East monsoon season — 16th October to 31st January;

(c) Hot weather season — 1st February to 31st May.

19. Meetings of the Committee. — (1)The Committee shall meet once in ten days during the months of June and October when the south-west and north-east monsoon set in and after the monsoon has set in, the

meeting will be held at least once a fortnight but the Committee shall have the powers to convene meetings as often as necessary. In case of any exigency, a minimum of forty-eight hours notice shall be given for holding a meeting.

(2) In case, the State which is likely to be affected is not represented in the meeting, then the possibility of calling another meeting will be considered by the Committee:

Provided that if the situation is such that it warrants to take immediate decision, then the Committee may decide the issue by majority vote even in the absence of representative from the affected State.

2612

(3) The quorum for meeting of the Committee shall be at least six.

(4) All the Members including the Chairman and Member Secretary of the Committee shall have voting right and the Chairman shall also have a casting vote."

Godavari and Krishna River Management Board

1334.

The Godavari and Krishna River Management Board have been set up by the Central Government in 2014, after bifurcation of the State of Andhra Pradesh in two separate States, namely, Andhra Pradesh and Telangana under 'The Andhra Pradesh Reorganisation Act, 2014. The relevant clause of the Act relating to Godavari and Krishna River Management Boards is covered under Part IX: Management and Development of Water Resources.

1335.

The constitution and

function
of
the
River
Management Board are mentioned under Clause 85 of the Act which is reproduced as under:

“85. (1) The Central Government shall constitute two separate Boards to be called the Godavari River Management Board and Krishna River Management Board (to be known as the Board), within a period of sixty days from the appointed day, for the administration, regulation, maintenance and operation

of such projects, as may be notified by the Central Government from time to time.

(2) The headquarters of Godavari River Management Board shall be located in the successor State of Telangana and of the Krishna River Management Board shall be located in the successor State of Telangana and of the Krishna River Management Board shall be located in the successor State of Andhra Pradesh.

(3) The Godavari River Management Board and Krishna River Management Board shall be autonomous bodies under the administrative control of the Central Government, and shall comply with such directions as may, from time to time, be given to them by the Central Government.

(4) Each Board shall consist of the following Chairperson and Members, namely:-

a. A Chairperson not below the rank or level of Secretary or Additional Secretary to the Government of India to be appointed by the

Central Government;

b. Two members, to be nominated by each of the successor States, of which one shall be the technical member not below the rank of Chief Engineer and the other administrative member to represent the concerned States;

c. One expert to be nominated by the Central Government.

(5) Each Board shall have a full-time Member Secretary, not below the rank of Chief Engineer in the Central Water Commission, to be appointed by the Central Government.

(6) The Central Government shall create such number of posts of the rank of Chief Engineer in the Central Water Commission, as it considers necessary.

(7) Each Board shall be assisted in the day to day management of reservoirs by the Central Industrial Security Force constituted under the Central Industrial Security Force Act, 1968 on such terms and conditions as the Central Government may specify.

(8) The functions of each Board shall include-

(a) the regulation of supply of water from the projects to the successor States having regard to-

(i) awards granted by the Tribunals constituted under the Inter-State River Water Disputes Act, 1956;

(ii) any agreement entered into or arrangement made covering the Government of existing State of Andhra Pradesh and any other State or Union territory;

(b) the regulation of supply of power generated to the authority in charge of the distribution of power having

regard to any agreement entered into or arrangement made covering the Government of the existing State of Andhra Pradesh and any other State or Union territory;

(c) the construction of such of the remaining ongoing or new works connected with the development of the water resources ;projects relating to the rivers or their tributaries through the successor States as the Central Government may specify by notification in the Official Gazette;

(d) making an appraisal of any proposal for construction of new projects on Godavari or Krishna rivers and giving technical clearance, after satisfying that such projects do not negatively impact the availability of water as per the awards of the Tribunal constituted under the Inter-

2615

State River Water Disputes Act, 1956 for the projects already completed or taken up before the appointed day; and

(e) such other functions as the Central Government may entrust to it on the basis of the principles specified in the Eleventh Schedule.

Krishna Waters Decision – Implementation Board

1336.

The Krishna Water Disputes Tribunal-II in his final order has recommended another scheme namely, Krishna Water Decision – Implementation Board and the details are appended as Appendix-I, Volume IV of the Report-2010. The relevant paragraphs relating to its composition, functions and powers are reproduced as under:

"1. There shall be a permanent "Krishna Water Decision Implementation Board", 'hereinafter referred to as the Board' which will have five Members out of which one Member each shall be appointed by the

three riparian States and the remaining two Members shall be nominated by the Central Government (Government of India).

2. The riparian States shall appoint Members on deputation or on re-employment basis, a person who should be a High ranking Engineer not below the rank of Chief Engineer or has held the office of Chief Engineer having experience in the field of Irrigation Engineering, Hydrology and Water Management.

3. The Central Government shall nominate two Mem bers for the “Krishna Water Decision – Implementation Board” who shall be High ranking Engineer having experience in the field of Irrigation Engineering, Hydrology and Water Management from Central Government services or any organization under the Central Government, one of whom shall be holding or has held the post not below the rank of Joint Secretary and the other not below the rank of Additional Secretary to the Government of India. The latter shall be the Chairman of the Board. The nominated Members shall be either on deputation or on re-employment but shall be from any State other than the riparian States of the Krishna river basin and shall have no connection, direct or indirect, with any of the three States.

4. The services of the Members including the Chairman of the Board as well as Officers and employees of the Board shall be subject to the Service and Disciplinary

Rules applicable to the Central Government Officers and employees except the Members and other Officers and employees serving on deputation who shall be governed by the Service Rules and Disciplinary Rules of the parent cadre of the concerned State.

…

9. The Board in its meeting in which all the members are present shall frame its Rules of business, categorize any part of the business of the Board as of a formal or routine nature.

10. The permanent “Krishna Waters Decision – Implementation Board” with five Members as aforesaid shall be for implementing and carrying out effectively

the decision/ orders and directions issued by this Tribunal including the decision/ orders and directions issued by K.W.D.T – I which have not been reviewed or modified by this Tribunal.

…

19. The Board shall employ a Secretary who shall be an Engineer having experience in Hydrology and water management. The appointment shall be on deputation or on re-employment basis not beyond 65 years of age.

…

21. The Board shall appoint a qualified and experienced Accounts Officer on deputation or on re-employment basis not beyond 65 years of age.

22. The Board shall ensure that the following data in respect of the flows and utilization of the waters of river Krishna are recorded and exchanged between the riparian States and a copy of the same shall also be furnished by the States to the Board in the same manner.

23. It shall also be ensured that the States furnish the copies of the Working Table at 10 daily basis and the Rule Curve to each other. The States shall also furnish such copies to the Board. The Board may vet the Rule Curve and the 10 daily Working Tables to check and ensure that they are prepared in consonance with the provisions of the decision of this Tribunal and the decision and directions of KWDT-I which have not been amended, modified or reviewed by this Tribunal. In case it is found that the 10 daily Working Tables or the Rule Curve does not conform to the decision, order and the directions of this Tribunal or the decision and directions of KWDT-I which have not been amended,

modified or reviewed, the Board may make necessary modifications which shall be binding on all the parties.

24. The Board shall be charged with the power and shall be under a duty to do all things necessary and sufficient and expedient for the implementation of the order/ directions of this Tribunal including the decision/ orders and directions of K.W.D.T.-I which have not been reviewed or modified by this Tribunal with respect to:-

(i) storage, apportionment and regulated control of the Krishna waters,

(ii) regulated releases from the reservoirs as directed by this Tribunal including the decision and directions of K.W.D.T. - I which have not been reviewed or modified by this Tribunal.

(iii) any other matter incidental to the carrying out and implementation of the order/ direction of this Tribunal including the decision and directions of K.W.D.T.-I which have not been reviewed or modified by this Tribunal.

(iv) The Board shall make use of the data of the gauging sites already established or as may be established by the Central Water Commission or cause to be established either by itself or through the Central Water Commission.

(v) Record shall be kept of the flow of the Krishna River at all stations considered necessary by the Board.

…

27. The Board shall collect from the States concerned data for the areas irrigated by Krishna waters in each season of withdrawals for irrigation, domestic,

2619

municipal and industrial or any other purpose and of water going down the river from the project.

…

29. The Board shall determine the volume of water flowing in the river Krishna and its tributaries in a water year i.e. 1 st June to 31 st May.

30. The Board shall check from time to time the volume of water stored by each State in its reservoirs and other storages and may for that purpose adopt any approved and tested device or method.

…"

1337.

The above referred scheme / board has not been notified by the Central Government.

Bhakra Beas Management Board

1338.

The Bhakra Management Board was constituted on 1 st October 1967 under the Punjab Re-organization Act, 1966 for administration, operation and maintenance of Bhakra-Nangal

Project that was started on river Satluj, immediately after independence in the joint collaboration of the erstwhile State of Punjab and the State of Rajasthan. The works of Beas Projects were undertaken by the Beas Construction Board under the

2620

Punjab Re-organization Act, 1966. On completion, the Beas projects were also transferred to Bhakra Management Board on 15 th May 1976 and it was re-named as Bhakra Beas Management Board (BBMB) as per the provisions of the Punjab Re-organization Act. The Board is working under the administrative control of the Union Ministry of Power, Government of India, New Delhi.

1339.

The Bhakra Beas Management Board is headed by a whole time Chairman and two whole-time Members, i.e. Member (Irrigation) and Member (Power). Besides the above, two representatives from the Central Government of the rank of Joint Secretary/ Commissioner to be nominated by the Ministry of Water Resources and Ministry of Power respectively and another four representatives, one each from the State Governments of Punjab, Haryana Rajasthan and Himachal Pradesh are nominated as part-time Members of the Board.

1340.

The functions of BBMB are as follows:

- Administration,operation and maintenance of Bhakra-Beas

Projects;

- Theregulation of supply of water from Bhakra Beas projects to the States of Punjab, Haryana and Rajasthan;

2621

- Theregulation of the supply of power generated at Bhakra Beas Projects;
- Anyother function as the Central Government may assign after consultation with the Governments of States of Punjab, Haryana and Rajasthan.

Vansadhara Supervisory Committee

1341.

The Vansadhara River originates in the State of Odisha and after flowing in between the two States, namely, States of Odisha and the State of Andhra Pradesh, enters sea in the Bay of Bengal. A dispute was arisen with regard to the use and management of the water of the said river between the aforesaid States. Therefore, a tribunal called Vansadhara Water Disputes Tribunal was constituted by the Central Government (the Union Ministry of Water Resources) vide Notification No. S.O. 465 (E) dated 24 th February, 2010 under Section 4 of the ISRWD Act,1956 relating to water dispute regarding the Inter-State River Vansadhara and the river valley thereof. The main points for disputes are related to the Neradi Barrage Project and Side Weir

Project proposed by the State Government of Andhra Pradesh on account of submergence of land in the State of Odisha. The

2622

Tribunal examined the issues raised by the party States and submitted its Report with Decisions in September, 2017.

1342.

Under the Clause X of the Award, the Vansadhara Water Disputes Tribunal has ordered to set up a Supervisory Committee for implementing the decision of the Tribunal. The Clause X of the aforesaid Award is reproduced as under:

“Setting up of the Supervisory Committee

We make the following orders with regard to setting up of Inter-State Regulatory Body (Supervisory Committee) for implementing the decision of the Tribunal. The composition, functions and powers of the Supervisory Committee are as follows:

(1) A Supervisory Committee consisting of four members – two from the Central Water Commission; one from the State of Andhra Pradesh; and one from the State of Odisha shall be constituted to supervise the functioning of the Side Weir complex at Katragada and Neradi Barrage when constructed and also for

implementation of the order of the Tribunal.

(2) The composition of the Committee shall be:

(i) Chief Engineer, CWC - Chairman

(ii) Representative of - Member

State of Andhra

Pradesh

(iii) Representative of - Member

State of Odisha

(iv) Superintending - Member Secretary

2623

Engineer / Director,

CWC

(3) The Committee shall have following functions and powers:

(i) To supervise the operation of the gates, of the Head Regulator of Flood Flow Canal of Side Weir complex, including the closure of the same.

(ii) To ensure that total drawal of water through Head Regulator of Flood Flow Canal of Side Weir complex, during the months of June to November in any year shall not in any Case exceed 8 TMC, constituting a part of 50% share of water of the State of Andhra Pradesh.

(iii) To ensure that the gates of the Head Regulator of the Flood Flow Canal of Side Weir complex, shall open on 1 st June and close on 1 st December or earlier as soon as the total drawal of water equals to 8 TMC every year and the

gates shall so remain closed till 31 st May of next year.

(iv) To maintain the record of the flow upstream of the Side Weir and also of the flow passing through the Head Regulator of Flood Flow Canal. When the Flood Flow Canal is operational, it may be ensured that the flow downstream of the Side Weir is equal to or more than 4000 cusecs.

(v) To make periodical survey, as it deems necessary, for assessing aggradation and degradation in the river near the Side Weir and take appropriate steps thereto so as to ensure

that the bed level of the Side Weir at all times shall be as per its original design.

(vi) To keep a close watch on the river behaviour and to ensure that if there be any silting or sedimentation in front of the Side Weir at Katragada or upstream near the Neradi Barrage, the same shall be got cleared, as and when required, through the State Government of Andhra Pradesh.

(vii) To ensure that the Side Weir is totally plugged and made completely non-functional immediately after commissioning of the Neradi Barrage.

(viii) To supervise the regulation of flows from Neradi Barrage so as to ensure:

(a) that the water from Vansadhara river at Neradi Barrage is withdrawn by the State of Andhra Pradesh and the State of Odisha during the period from 1 st of June to 30 th of

November every year.

(b) that during the period from 1 st December to 31 st May every year, entire water reaching Neradi Barrage, flows down the river for use by both the States.

(ix)

To visit the flood affected areas of Odisha, if any, impacted due to the backwater of Neradi Barrage beyond its pool level and make assessment for giving recommendations regarding compensation to be paid to the flood affected families/persons. For this purpose, the

2625

Committee may co-opt any member(s) as it deems fit.

(4) The Committee shall select the place for its office which shall be provided by the State of Andhra Pradesh.

(5) The expenses for the maintenance of office and all expenses for conducting the monitoring activity shall be borne by the State of Andhra Pradesh.

The Central Government and the party States shall nominate members of the Supervisory Committee at the earliest, in any case, not later than 3 months from the date of publication of this decision in the official Gazette. No decision of the Supervisory Committee shall be invalid merely because of non-appointment of any member by any State or by reason of absence of any member."

Hon'ble Supreme Court Judgment on Babhali Barrage Project reported in 1998 (7) SCC, P-303

1343.

Hon'ble Supreme Court of India in a dispute arising

over Babhali Barrage in the Godavari River basin between the State of Andhra Pradesh vs State of Maharashtra pronounced the judgment on 28 th April, 2013 wherein, the Hon'ble Supreme Court has ordered to constitute a three Members Supervisory Committee to supervise the provisions of Inter-State Agreements dated 06.10.1975 and 19.12.1975 on Godavari waters. The suit

2626

was filed by Andhra Pradesh complaining violations by Maharashtra of the provisions of the said Inter-State Agreements dated 06.10.1975 and 19.12.1975.

1344.

The Godavari River, which is the largest river in Peninsular India, originates in the Sahayadri hills at an altitude of 3500 ft in Nasik district of Maharashtra and flows for a length of about 1465 km through Maharashtra and Andhra Pradesh before joining the Bay of Bengal. After the river enters in the Andhra Pradesh, the State of Andhra Pradesh constructed a 140 ft high dam, at a distance of 764 km from its origin, known as Pochampad dam (Sriram Sagar Project) after the inter-state agreement signed on 06.10.1975 between the party States. The Sriram Sagar reservoir at its designed FRL spreads 55 kms inside the territory of Maharashtra in the upstream.

1345.

In the year 1995, the Maharashtra Government started a medium irrigation scheme, called Babhali Barrage Project unilaterally to provide water to Rabi irrigation in Nanded

district. The said barrage was located 7 kms upstream of Maharashtra – Andhra Pradesh border on the main Godavari having a storage capacity of 2.74 TMC water during non-

monsoon period. The State Government of Andhra Pradesh objected to the said scheme as its location lies within the existing Pochampad dam reservoir. Learned senior counsel for Andhra Pradesh pleaded that Maharashtra would use the waters stored in the Sriram Sagar reservoir in their territory; for which they had no such right as per the interstate agreements. On the other hand, learned senior counsel for Maharashtra argued that the agreement dated 06.10.1975 between Andhra Pradesh and Maharashtra is an agreement for the equitable distribution of waters of Godavari river and they are entitled to construct new projects, within the overall cap of 60 tmc allocated to Maharashtra by the Tribunal, inside its territory.

1346.

After examining the documents placed before the Court in the matter, the aforesaid original suit was disposed of by the Hon'ble Supreme Court of In dia with the following directions:

"83. However, a three member supervisory committee is constituted. The committee shall have one representative from the Central Water Commission and

one representative each from the two States, Andhra Pradesh and Maharashtra. The representative of Central Water Commission shall be Chairman of the committee. The Committee shall select the place for its office which

shall be provided by Maharashtra. Maharashtra shall bear the entire expenditure of the Committee. The powers and functions of the supervisory committee shall be as follows:

(i) The Committee shall supervise the operation of the Babhali Barrage, and

(ii) The Committee shall ensure that;

a) Maharashtra maintains Babhali barrage storage capacity of 2.74 TMC of water out of the allocation of 60 TMC given to Maharashtra for new projects under the agreement dated 06.10.1975.

b) The gates of Babhali barrage remain lifted during the monsoon season i.e, July 1 to October 28 and there is no obstruction to the natural flow of Godavari river during monsoon season below the three dams mentioned in Clause II(i) of the agreement dated 06.10.1975 towards Pochampad dam.

c) During the non-monsoon season i.e., from October 29 till the end of June next year, the quantity of water which Maharashtra utilizes for Babhali barrage does not exceed 2.74 TMC of which only 0.6 TMC forms the common submergence of Pochampad reservoir and Babhali barrage.

d) Maharashtra does not periodically utilize 2.74 TMC from time to time.

…”

2629

Important Activities Essentially Required to be undertaken for Sustainable Development of Water Resources of Mahadayi Basin

1347.

The Tribunal has noticed that all the party States namely, Goa, Karnataka and Maharashtra were unable to present before the Tribunal any comprehensive plan for sustainable development of water resources of Mahadayi basin for beneficial use by the society. The Tribunal finds that hydro-meteorological and hydrological data, which were produced before the Tribunal by the party States, were not consistent and reliable. The Tribunal also notices that the detailed project reports (DPRs) of various identified schemes / projects, were incomplete and not at all bankable / reliable. The three State Governments have presented several water related information and projections in respect of future plans etc. but such information provided by one party State were seriously contested by other party State(s). Further, in most of the cases, the information / future action plans are not supported by needed scientific investigations,

research, studies, etc.

1348.

The Tribunal is of firm view that environmental issues

are very important and crucial in respect of Mahadayi river basin.

2630

However, it is noticed that except for providing general information, none of the party States have: (a) presented scientifically collected data / information; (b) undertaken object-oriented investigations; (c) carried out research / studies; and (d) prepared long term action plan to address the related issues.

1349.

Keeping in view the serious differences of opinion amongst the party States, the Tribunal is of the firm view that an independent body i.e., 'Mahadayi Water Management Authority', must undertake following activities with the cooperation and active participation of the party States in respect of following.

a. Collecting all water related data (including hydro-meteorological

data

and

hydrological

data)

and

preparation of water resources profile of the basin / sub-basin and in respect of various identified projects / schemes.

b. Undertaking investigations / research / studies on all aspects of environmental issues, including that in respect of impact of climate change on water resources etc. and preparation of short term / long term action plans to address the issues.

2631

c. Preparation of comprehensive plan for sustainable development of water resources with active participation of States.

d. Monitoring and regulation of existing as well as future projects / schemes.

Constitution of the Authority

1350.

The Central Government shall constitute an Authority, called ‘Mahadayi Water Management Authority’ to implement the Report and final decision of Mahadayi Water Disputes Tribunal.

1351.

The Authority shall own and operate the projects for diversion of Mahadayi waters, situated/ located in the State of Karnataka and State of Maharashtra.

1352.

The Authority shall consist of seven high-ranking professional as members, of whom one each shall be of the rank of Engineer-in-Chief, Chief Engineer or Additional Chief Engineer

of the Water Resources Department of each of the States of Goa, Karnataka and Maharashtra and four other eminent independent

2632

Engineers / Professionals, of a rank, not less than that of a Chief Engineer, to be appointed by the Central Government with expertise in the areas of (a) Hydrology, (b) Environmental Issues, (c) Water Resources Planning, and (d) Monitoring and Regulation of Water Resources Projects / Schemes.

One of the four

independent Members, to be appointed by the Central Government, shall be nominated by the Central Government as the Chairman of the Authority, with a deliberative vote, at meetings, where decisions are taken, on any matter affecting the interest of more than one State and he will be In-charge of the administrative work of the Authority. The Central Government or State Government, as the case may be, shall have the power to remove or suspend from the Authority any Member, who, in its opinion, is not suitable to continue as Member.

1353.

Each independent Member appointed by the Central Government, shall be a full time Member and be appointed for a term not exceeding three years. The Members appointed by the

State Governments shall be part-time Members of the Authority. The post of the Chairman of the Authority shall be a cadre post of Central Water Commission (CWC) so that the question of officers, if unwilling for deputation, is redeemed. Appointment of other

2633

Members of the Authority, by Central Government as well the party-States shall be by rotation. As far as practicable, the first appointment of the seven Members of the Authority shall be made within three months, from the date of publication of the decision of the Mahadayi Water Disputes Tribunal, in the Official Gazette.

Vacancies of Members

1354.

On any vacancy occurring in the office of the four independent Members, the Central Government shall appoint a person to such vacant office, and on any vacancy occurring in the office of the three Members, other than the independent Members, the State Government by whom the Member, whose office falls vacant, was appointed, shall appoint, a person to the vacant office.

1355.

In case of illness or absence, for any cause whatsoever, of a Member, the Central Government or State Government, by whom he was appointed, may appoint a person

as an acting Member, during such illness or absence and such acting Member shall, while so acting, would have all the powers

2634

and perform, all the duties and be entitled to the indemnities of the Member in whose stead, he so acts, save and except that the next senior independent Member, appointed by the Central Government and not the acting Member, shall act as Chairman at business meeting of the Authority or as the Chairman of the Authority in the event of illness or absence of the Chairman of the Authority.

1356.

The Authority shall employ a Secretary, who shall be an Engineer. He shall not be a Member of the Authority.

Quorum and Voting

1357.

Five Members shall be the Quorum and the concurrence of the majority shall be necessary for the transaction of the business of the Authority, except such business, as the Authority may, from time to time, prescribe as routine. The Authority shall not prescribe, as routine, any business in which the interests of any two of the States are likely to be in conflict. In the transaction of routine business, three

Members shall be the quorum and in the absence of the Chairman of the Authority, the Chairman allocated at the

2635

meeting, shall have a Deliberative vote, in the event of equality of votes a casting vote also. Subject to, as aforesaid, the Members shall have equal powers.

Disposal of Business by the Authority

1358.

Subject to the provisions contained in para 1359 below, the Authority may dispose of any matter before it, either by circulation or by holding a meeting. However, it will be open to any Member of the Authority, to require that a matter shall not be disposed of by circulation but at a meeting.

1359.

On the following matters, the Authority shall record its decision by a resolution, at a meeting in which the Chairman and all the Members from the party-States are present:-

(i) Framing of rules of business;

(ii) Delegation of functions to a Member or Secretary or any official of the Authority;

(iii) Categorizing any part of the business of the Authority as a formal or routine nature; and

2636

(iv) Any other matter, which any of the three party-States require that it shall be decided at a meeting where all the Members from the party-States are present.

1360.

However, if any particular item under the provisions of para 1359 above, cannot be disposed of at two successful meetings, owing to the absence of one or more Members from the party-States, it shall be disposed of as per the provisions under para 1357 above.

1361.

Subject to the foregoing provisions, the Authority shall frame its own rules for the conduct of its business.

1362.

The Authority shall cause proper minutes or records of all its proceedings to be kept as a permanent record.

Indemnity of Members

1363.

No Member, officer or employee of the Authority shall be liable for losses, injury or damages resulting

from:-

2637

(i) action taken by such Member, officer or employee in good-faith and without malice under the apparent authority or the orders, even though such action is later determined to be unauthorized or;

(ii) the neglect or wrongful act or omission of any other person, employed by the Authority and serving under such Member, officer or employee, unless such Member, officer or employee failed to exercise due care in the appointment of such other person or the supervision of his work.

Officers and Servants of the Authority

1364.

The Authority may, from time to time, appoint or employ such and so many officers and servants, as it thinks fit, and remove or dismiss them, under the Rules and Regulations, applicable to the appointment, removal and dismissal of Central Government officers and servants.

1365.

Persons employed in the service of the three

States may be appointed or employed by the Authority in such proportions as the Authority may deem fit. The Authority shall

2638

arrange with the State Governments to spare the services of the persons employed in the State Governments for whole time employment with the Authority, or for the performance of any work or services for the Authority. The Authority may also make direct recruitment of any personnel or obtain the same from the Centre or other source as it considers appropriate.

1366.

All such officers and servants shall, as such, be subjected to the sole control of the Authority. The scales of pay and other service conditions shall be as applicable to the Central government employees and/or State Government employees.

Administrative and Field Organisation Cost

1367.

The expenses of the Authority (including the salary and expenses of the independent Members), shall be borne by the State Governments of Goa, Karnataka and Maharashtra in equal shares. The expenses pertaining to a Member, representing the State, shall be borne by the State concerned. The cost of maintaining, operating and controlling the office of Authority,

gauging and other Hydrological stations, for each State, and

2639

telecommunication systems for communicating the data, shall be borne by the State concerned.

1368.

The cost of construction of the storages, power installation, diversion works, hand works and casual need works, shall be borne wholly by the State Government, in whose territory the work is allocated.

Power, Functions and Duties of the Authority

1369.

The Authority shall be charged with the power and shall be under a duty to do any or all things necessary, sufficient and expedient for the implementation of the Report/Final Decision/Award of the 'Mahadayi Water Disputes Tribunal', with respect to:

a. Storage, apportionment, regulation and control of the waters of Mahadayi River.

b. Regulate releases from the Mahadayi Basin, as directed by the Mahadayi Water Disputes Tribunal.

c. Any other matter, incidental to the carrying out and implementation of the order/direction of the Mahadayi Water Disputes Tribunal.

d. The Authority shall make use of the data of sites, already established or as may be established by the Central Water Commission or by the three State Governments or cause to be established either by itself or through some approved Agency.

e. Records shall be kept of the flow of the Mahadayi river including the diversion of Mahadayi waters to other basins, and diversion of water from other rivers to Mahadayi basin, at all stations, considered necessary by the Authority.

f. The Authority shall collect from all the three States concerned, all water related data, particularly the data for the areas irrigated by the Mahadayi waters in each season, data in respect of withdrawals for irrigation, domestic, municipal, industrial or any other purpose and of the water going down the river from various projects / schemes.

g. The Authority shall determine the volume of water flowing in the river Mahadayi and its tributaries in a water year i.e. 1 st June to 31 st May; and prepare the Water Year Book(s).

h. The Authority shall check from time to time the volume of

water stored by each State in its reservoirs and other storages and shall, for that purpose, adopt any approved and tested devices or method/s.

2641

EQUITABLE APPORTIONMENT OF WATERS OF MAHADAYI RIVER

1370.

The Government of Goa, in its “Request for appointment of a River Water Disputes Judicial Tribunal under Section-3 of the Inter-State Water Disputes Act, 1956 as amended” vide its letter No. 68 -4/CE-WRD-DO-2002-03/208 dated 09/07/2002 addressed to the Secretary, Union Ministry of Water Resources, Government of India, had requested for adjudicating and deciding the equitable shares of Mahadayi water among the three co-basin States, in para 28(ii), which is reproduced hereunder.

“ 28.0 Therefore the MOWR, Govt. of India, is strongly urged to appoint immediately a Judicial Tribunal as provided for under Section-3 of the Interstate Water Disputes Act, 1956 as amended and refer the following matters for adjudication and decision.

ii) To adjudicate and decide the equitable shares of the three co-basin states in the above quantity of water taking into consideration the long term in basin needs

of the three States for the beneficial uses of water (water supply, irrigation, hydropower generation, navigation, pisciculture and environmental protection, etc.) .”

2642

1371.

The State of Goa has requested for determining and laying down the true and correct principles applicable for equitable use of waters from the Mahadayi River basin/Mahadayi River and for issuing appropriate directions at para 225 of the “Amended Statement of Case of the State of Goa filed before Mahadayi Water Disputes Tribunal” (Vol ume 131). The same are reproduced hereunder.

“225. In the light of the aforesaid facts and circumstances, the State of Goa prays for the following reliefs:-

…

(C) Without prejudice to the prayer clauses (A) and (B) above and in the alternative,

(i) That this Hon’ble Tribunal be pleased to determine the true and correct principles applicable for equitable use of waters from the Mahadayi River basin/Mahadayi River and issue appropriate directions in that regard;

(ii) That this Hon’ble Tribunal be pleased to determine the share of all the riparian States on the remainder waters of Mahadayi River, if any available, after assessing and deducting the same from the available waters of Mahadayi River, the water requirement of ecological sustenance of the River valley eternally, specifically giving due consideration of the

2643

scientifically predicted global warming, sea level increase, increased salinity ingress in coastal areas, etc.;

(iii) That this Hon'ble Tribunal be pleased to direct the State of Karnataka and State of Maharashtra to declare their present upstream use including use by Rainwater Harvesting and such use may be counted against the share of State of Karnataka and State of Maharashtra. "

1372.

The Government of Karnataka, vide its letter No. WRD/08/KDM/2009 dated 22.06.2010 filed as complaint under Section 3 of the Inter State River Water Disputes Act, 1956, read with Inter-State Water Disputes Rules 1959, addressed to the Secretary to the Government of India, Ministry of Water Resources, had inter-alia, made following specific references related to water demands and equitable apportionment.

"…

(d) On an equitable apportionment of the waters of the

inter-State river Mahadayi and its valley, whether, the equitable share of the riparian State of Karnataka is not less than 45 tmc annually (consumptive use of 24.15 tmc)?

…"

1373.

In the Amended Statement of Claims filed on 20.4.2015 (Volume 129), the State of Karnataka has referred to

the aspects of equitable apportionment of waters of the inter-State river Mahadayi and its valley, at paras 10.5, 11.1(c) & (d), 13.1(a) and 17.1(i) which are as under:

"…

10.5 … However, the claims made by the riparian States even if considered in its entirety, there is no conflict requiring apportionment of the water. The State of Karnataka, in its Complaint has claimed its equitable share in Mahadayi as *"notless than 45 tmc (consumptive utilisation restricted to 24.15 tmc").*

…

11.1 The specific matters in dispute raised in its Complaint are:

(c) What is the contribution of water of each of the riparian States of Karnataka, Goa and Maharashtra to the available water of interstate river Mahadayi and its valley?

(d) On an equitable apportionment of the waters of the interstate river Mahadayi and its valley, whether, the

equitable share of the riparian State of Karnataka is not less than 45 tmc annually (consumptive use of 24.15 tmc)?

…

13.1 (a) As submitted above, Karnataka has claimed, as a part of its share on equitable apportionment, a consumptive utilisation of 24.15 tmc from the waters of Mahadayi basin, as stated in its Complaint dated 22.06.2010 filed under Sec.3 of the Act of 1956.

...

2645

17.1 Under the above circumstances, and having regard to the requirements of justice and equity, the State of Karnataka humbly prays before this Hon'ble Tribunal to:

(i) Hold that Karnataka's share in the waters of inter-State river Mahadayi and its valley is not less than 24.15 tmc for consumptive utilisation;

…"

1374.

The Government of Maharashtra, in its "Letter of Complaint under Section 3 of the Inter State River Water Disputes Act, 1956, Read with Inter-State Water Disputes Rules 1959"

vide

letter

No.

Mandvi -2010/CR-247/WRP

dated

13.10.2010 addressed to the Secretary to the Government of India, Ministry of Water Resources (pages 41-47, Vol. 1), has not

indicated any specific quantum of water of Mahadayi river basin as the share of the State of Maharashtra. However, the para which directly or indirectly refers to the issue of the equitable apportionment of the water of Mahadayi river basin, in the above mentioned letter / complaint of the State of Maharashtra is reproduced hereunder.

“ Para 3. Specific Matters in Dispute;

(I) The following matters *interalia* wouldarise for adjudication and consequent decision of the Tribunal.

…

2646

(b) What would be the share of each State on equitable apportionment of water of the Inter State River Mandovi?

…”

1375.

The Tribunal notes that neither the State of Goa nor the State of Karnataka, in their Statement of Case / Statement of Claims, have suggested the principles and/or methods to be adopted by the Tribunal, for equitable apportionment of the waters, of Mahadayi river, among the party States.

1376.

However, the State of Maharashtra has discussed the aspects of equitable apportionment in Chapter 4 of its Statement of Case (Volume 127), which, inter-alia, covers the principles to be adopted for apportionment of water. Chapter 4 of the Statement of Case of the State of Maharashtra (Vol. 127), is reproduced hereunder.

“ CHAPTER 4

EQUITABLE APPORTIONMENT OF WATERS OF RIVER

MANDOVI

4.1.1 ThisHon'ble Tribunal has been given the task of distribution of Waters of River Mandovi between the

three riparian States i.e. Goa, Karnataka and Maharashtra. The apportionment has to be in respect of waters of the entire "Mandovi River Basin" in an equitable manner on the basis of the evidence adduced by the party States before this Hon'ble Tribunal.

4.1.2 TheState's requirement of water would be for -

1. Irrigation
2. Power Generation
3. Drinking purposes
4. Industrial purposes
5. Navigation
6. Fisheries
7. Storages
8. Diversion of water outside basin
9. Competing priority between -

i. Irrigation vs. Drinking water;

ii. Rural vs. Urban demand;

iii. Irrigation / Powergeneration vs. Flood moderation;

iv. Cost of construction of uses vs. Maintenance of minimum flow;

v. Irrigation vs. Fish culture;

vi. Wet crop vs. Aqua culture;

vii. Rice cultivation vs. Irrigated dry crop:

viii. Irrigation vs. Hydropower generation;

ix. Peak demand of Hydropower generation vs. Peak demand for Irrigation and;

x. Tourism vs. Hydropower.

10. Any other beneficial use.

4.1.3 Theequitable distribution does not have any straight jacket formula as each river basin has unique

characteristics. Following factors amongst others would be relevant in determining the share while distributing waters equitably.

1. Population
2. Drainage contribution
3. Priority of various uses of water
4. Committed uses
5. Economic and social needs of riparian States
6. Geography, Hydrology and drainage area of the basin
7. Scarcity or drought prone area in the basin
8. Culturable area in the basin
9. Dependability at which water is distributable
10. Demands outside the basin

4.1.4 TheState of Maharashtra will rely on the following Acts and authorities:-

1.
2.
3.

4.

5.

6.

7.

8.

9.

The Inter-State Water Disputes Act, 1956

The River Board Act 1956

The Constitution of India

Report of the Indus Commission

Decisions of the Indian Courts, River Tribunals,

Supreme Court of USA and other countries

International Law on Equitable Apportionment

Helsinki Rules of International Law Association

Settlement of International and Inter-State Water

Disputes In India

Any other relevant material on the subject.”

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1377.

Although various aspects to be considered for equitable apportionment of water of a basin have been described in the Chapter 4 of the “Further Amended Sta tement of case of the State of Maharashtra” (Volume 127), the Tribunal does not find specific information and details relating to Mahadayi river basin which could be useful in deciding the equitable share. The Tribunal notes that the requisite details are not furnished by the State of Maharashtra in respect of Mahadayi river basin to which the stated principles for equitable apportionment of water of river Mahadayi among the party States, should be applied.

1378.

Further, during his arguments on 19.2.2018, Shri D. M. Nargolkar, learned Counsel for the State of Maharashtra, discussed the aspects of Principles of Equitable Distribution of Waters and in particular, he referred to the Article IV and Article V of the Helsinki Rule and Articles 10 to 16 of the International Law Association, Berlin Conference (2004). Shri Nargolkar also

referred to the observations of the Krishna Water Disputes Tribunal – I (KWDT-I), and concluded as under.

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“It is therefore, submitted that the available water, at 75% dependability, be distributed between all the three riparian States on the above mentioned principles for equitable distribution.”

1379.

The Tribunal also notes that the learned Counsel for the State of Karnataka has, on different occasions, referred to the Helsinki Rule and International Law Association, Berlin Conference (2004).

1380.

The Tribunal proposes to reproduce the relevant Articles from the Helsinki Rule which are as under.

“ Article IV

Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin.

Article V

1. What is a reasonable and equitable share within the meaning of Article IV is to be determined in the

light of all the relevant factors in each particular case.

2. Relevant factors which are to be considered include, but are not limited to:

2651

a) the geography of the basin, including in particular the extent of the drainage area in the territory of each basin State;

b) the hydrology of the basin, including in particular the contribution of water by each basin State;

c) the climate affecting the basin;

d) the past utilization of the waters of the basin, including in particular existing utilization;

e) the economic and social needs of each basin State;

f) the population dependent on the waters of the basin in each basin State;

g) the comparative costs of alternative means of satisfying the economic and social needs of each basin State;

h) the availability of other resources;

i) the avoidance of unnecessary waste in the utilization of waters of the basin;

j) the practicability of compensation to one or more

of the co-basin States as a means of adjusting conflicts among uses; and

k) the degree to which the needs of a basin State may be satisfied, without causing substantial injury to a co-basin State.

3. The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and equitable share, all relevant factors are to be considered together and a conclusion reached on the basis of the whole. ”

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The relevant Articles from the International Law Association, Berlin Conference (2004) (MARK-KA/16) are also reproduced hereunder.

Article 10

Participation by Basin States

1. Basin States have the right to participate in the management of waters of an international drainage basin in an equitable, reasonable, and sustainable manner.

2. Basin States shall define the waters to which an international agreement regarding the management of waters of an international drainage basin applies; such an international agreement may apply to all or part of the waters of an international drainage basin or to a particular project or use, except that a use by one or more basin States shall not cause a significant adverse effect on the rights of or uses in another basin State without the latter State's

express consent.

Article 11

Cooperation

Basin States shall cooperate in good faith in the management of waters of an international drainage basin for the mutual benefit of the participating States.

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Article 12

Equitable Utilization

1. Basin States shall in their respective territories manage the waters of an international drainage basin in an equitable and reasonable manner having due regard for the obligation not to cause significant harm to other basin States.

2. In particular, basin States shall develop and use the waters of the basin in order to attain the optimal and sustainable use thereof and benefits therefrom, taking into account the interests of other basin States, consistent with adequate protection of the waters.

Article 13

Determining an Equitable and Reasonable Use

1. Equitable and reasonable use within the meaning of Article 12 is to be determined through consideration of all relevant factors in each particular case.

2. Relevant factors to be considered include, but are not limited to:

a. Geographic, hydrographic, hydrological, hydrogeological, climatic, ecological, and other natural features;

b. The social and economic needs of the basin States concerned;

c. The population dependent on the waters of the international drainage basin in each basin State;

d. The effects of the use or uses of the waters of the international drainage basin in one basin State upon other basin States;

e. Existing and potential uses of the waters of the international drainage basin;

f. Conservation, protection, development, and economy of use of the water resources of the international drainage basin and the costs of measures taken to achieve these purposes;

g. The availability of alternatives, of comparable value, to the particular planned or existing use;

h. The sustainability of proposed or existing uses; and

i. The minimization of environmental harm.

3. The weight of each factor is to be determined by its importance in comparison with other relevant factors. In determining what is a reasonable and

equitable use, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.

Article 14

Preferences among Uses

1. In determining an equitable and reasonable use, States shall first allocate waters to satisfy vital human needs.

2. No other use or category of uses shall have an inherent preference over any other use or category of uses.

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Article 15

Using Allocated Water in Other Basin States

1. Allocation by agreement or otherwise to one basin State does not prevent use by another basin State to the extent that the basin State to which the water is allocated does not in fact use of the water.

2. Use of a water for purposes of this Article includes water necessary to assure ecological flows or otherwise to maintain ecological integrity or to minimize environmental harm.

3. Use of water by a basin State other than the one to which the water is allocated does not preclude the basin State to which the water is allocated from using the water when it chooses to do so.

Article 16

Avoidance of Transboundary Harm

Basin States, in managing the waters of an international drainage basin, shall refrain from and prevent acts or

omissions within their territory that cause significant harm to another basin State having due regard for the right of each basin State to make equitable and reasonable use of the waters.

1381.

While arguing on 21.2.2018, Shri Mohan V. Katarki, learned Counsel for the State of Karnataka, also mentioned about the three categories of river basins from the view point of

apportionment of water resources of the basin. Relevant extracts from his note of arguments are reproduced hereunder.

“ 2.1 The equitable apportionment of interstate rivers broadly falls into three categories. These are (1) fully appropriated basin; (2) semi appropriated basin; and (3) virgin basin.

2.2 The case relied upon by Counsel for the State of Goa on 20.02.2018 namely **Stateof Colorado vs. State of New Mexico (74 Led 2d 348)** fallsin the first category. Justice Marshal in the very first paragraph of his opinion (542 states that – *“thewater of the Vermejo River is at present fully appropriated by users in New Mexico”.* Hefurther states that *“Coloradoseeks to divert water for future uses”.* Inthis context, Justice Marshal concluded that “…. *itis entirely appropriate to consider the extent to which reasonable conservation measures by New Mexico might offset the proposed Colorado diversion and thereby minimize any injury to New Mexico users. Similarly, it is appropriate to consider*

whether Colorado has undertaken reasonable steps to minimize the amount of diversion that will be required".

Therefore, the downstream State new Mexico was mandated to show the reasonable conservation measures taken by it to reduce the wastage. Similarly, the upstream Colorado State was also mandated to show whether it has undertaken reasonable steps to minimize the diversion or demands.

2.3 However, this principle cannot and should not be applied to the basins falling in Category 2 or 3 mentioned above in para 2.1. The interstate Mahadayi

basin falls in category 2 if not category 3. The existing utilization in the basin are 9.395 tmc which is less than 10% of the water allegedly estimated by Mr. Chetan Pandit or 5% of the yield of 199.60 tmc as estimated by CWC in 2003 at 75% dependability. The rest of the water is all the determination of future uses of downstream Goa and upstream States of Maharashtra and Karnataka. Even in the determination of future uses of both the States, the question is whether the claims of three States can be accommodated within the available water. If it is possible to accommodate the claims of three States within the available water, then there is no need for either conservation in downstream Goa or minimization of demands in the up streams States of Karnataka and Maharashtra. If the process of conservation and minimization namely verification of the claims is undertaken and the claims are reduced or disallowed, it would not serve any purpose. The overriding consideration in any equitable

apportionment is that the scrutiny of the riparian States should not result in allowing the water to go to Sea. ”

1382.

The issues relating to equitable apportionment and allocation of water to party States, have been examined in detail by the Hon’ble Supreme Court in case of Cauvery (2018) 4 SCC 1. Apart from references to the averments made by the learned Counsel for the party Stat es, the Hon’ble Supreme Court has examined the aspect relating to equitable apportionment at paras 397 to 413.

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1383.

Hon’ble Supreme Court has reproduced all the relevant factors to be considered for arriving at the reasonable and equitable share as identified in Article V of the Helsinki Rule in para 397 of its Judgment and the Hon’ble Supreme Court has laid emphasis on the following factors.

a. The economic and social needs of each basin state

b. The population dependent on the waters of the basin in each basin state

c. The availability of other resources

1384.

At para 398 of its Order, the Hon’ble Supreme Court, has, inter-alia, observed as under.

“… The above factors, although not exhaustive, have been construed to be of significant bearing to ascertain the reasonable and equitable share of waters in an international drainage basin. The said principles can be regarded as functional dynamics while equitable distributing the water in an inter-State river disputes.

The salient feature of all these factors has to have inherent variability and inevitable flexibility thereof having regard to the local conditions, for it is difficult to ignore the undeniable and common emphasis necessary to ensure beneficial use of the available resources for a basin state and logically for its dependent populace

warranted by the economic and social needs. Be it stated, while determining the said needs, amongst others, past and existing utilization of the water have to be borne in mind. To remain oblivious to the same would amount to playing possum with the doctrine of equitable distribution *inpraesenti* ….”

1385.

In view of above, the Tribunal considers it proper and necessary to examine all facts relating to apportionment of water of Mahadayi river basin in light of the relevant Articles of the Helsinki Rule and the International Law Association, Berlin Conference (2004) (MARK-KA/16) and particularly keeping in view the specific observations of the Hon’ble Supreme Court.

1386.

The Tribunal notes that the information made available by the party States are not at all adequate to examine the various factors identified for arriving at the reasonable and equitable share as identified in Article V of the Helsinki Rule and the relevant Articles of the the International Law Association,

Berlin Conference (2004) (MARK-KA/16). As a matter of fact, the information and details provided by the party States are neither (a) consistent, nor (b) based on proper investigation, nor (c) backed by scientific research, nor (d) supported by detailed

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analysis, nor (e) presented in the form of bankable project reports. The Tribunal also notes that none of the projects / schemes identified for utilization of water resources of the Mahadayi basin, have got mandatory clearances. In this regard, it is noted by the Tribunal that the above deficiencies remain un-addressed despite specific observations and direction of the Tribunal from time to time.

1387.

The Tribunal along with legal and technical teams of the three co-basin States, visited various relevant projects / sites etc. in the States of Goa, Karnataka and Maharashtra during December 12-24, 2013. After completion of the last programme i.e., meeting with the officials of the Government of Karnataka on 23 rd December 2013, where members of the legal and technical teams of all the three States were present, the Chairman, Mahadayi Water Disputes Tribunal made his concluding remarks. The Chairman, inter-alia- stated as under.

"…

I would like to share with you some of the common

observations which emerged during visit to various sites etc. in Goa, Karnataka and Maharashtra.

Some important facts about basin features as also about water related points were highlighted by experts. But it emerged that many of the facts are neither included in the statement of case or statement of claims of the States nor adequately elaborated.

Another very important point relates to inconsistency in information and data. This was apparent at almost all the sites which were visited in Goa, Maharashtra and Karnataka.

It also emerged that in many cases, the information were not fully substantiated through facts, authentic information etc. such as detailed plan including contour plan, detailed drawings and construction drawings wherever applicable.

I am confident that the members of the legal and technical teams will take all necessary measures to ensure that the information and data are consistent and that these are duly substantiated through authentic sources, proper studies and related documents. This will

help all of us in better appreciation of the issues.

…”

1388.

During the course of hearing on 3.9.2014, the Tribunal handed over copies of the “Brief Note on Inconsistencies in Data / Information related to Water Availability and Water Requirements projected by the States of Goa, Karnataka and Maharashtra through the Statements of Case / Statement of

Claims and Related Documents" to the learned Counsel appearing in the matter. The relevant extracts from the Brief Note are reproduced hereunder.

" 1. Two basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various stakeholders and for different purposes are: (a) water availability assessed at various locations; and (b) water requirements for meeting the present and future demands of water for various purposes. In addition, information related to prioritization of water use keeping in view the socio-/economic profile of the areas are also considered necessary. Though the legal issues are undoubtedly very important but rational assessment of water availability and water requirements for various purposes on a sound and accepted principles remain basic inputs.

2. The statements of case / statement of claims, written statements and rejoinders submitted by the three co-basin States along with the related documents

provide some information relating to these two basic inputs, the examination of the documents provided by the three States indicates that in many cases, the information provided by the respective States are not consistent and in some cases are contradictory. Some inconsistencies were also observed by the Tribunal during the visit to various projects / sites etc. in the States of Goa, Karnataka and Maharashtra in December 2013 which are indicated in the report on the visit. Obviously, inconsistent informations cannot be the basis

of meaningful arguments during the process of arriving at reasonable assessment of the available water resources and judicious allocation of share of waters among the various stakeholders and for different purposes.

3. Without going into the merits of the facts as provided through data and informations included in the documents filed by respective State Governments and without comparing the data / information provided by one State with that of other States at this stage, some specific cases of inconsistencies in data / information appearing in the documents are cited as under.

…"

Thereafter, a detailed Order was passed by the Tribunal giving directions to the three party States as well as the Central Government with a view to securing the required material, data etc. to enable the Tribunal to decide the basic inputs essentially required during the course of decision making process of judicious allocation of share of waters among the various

stakeholders.

1389.

However, the Tribunal notes that despite clear directions, the respective States have failed to provide requisite information which are adequate and consistent, based on proper

investigation, backed by scientific research and studies and supported by detailed analysis. In particular, the specific issues such as (a) the economic and social needs of each basin state, (b) the dependence of the population on the waters of the basin in each basin state, and (c) the availability of other resources, have not at all been examined by any of the States in scientific manner. In this regard, the Tribunal also notes that two important aspects, namely (a) sustainability, and (b) minimization of environmental harm, have not been scientifically examined by the States while presenting their case for future projection of water demand. In this regard, the relevant Articles from International Law Association, Berlin Conference (2004) (MARK-KA/16), are reproduced hereunder.

“…

Article 7

Sustainability

States shall take all appropriate measures to manage waters sustainably.

…

Article 8

Minimization of Environmental Harm

States shall take all appropriate measures to prevent or minimize environmental harm.

…”

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1390.

Apart from the fact that the requisite scientific studies are not on the record, the Tribunal has also come across serious issues of conflicting interpretation. The Tribunal notes that this aspect has also been flagged by the Hon'ble Supreme Court at para 379 of its Order. The relevant extract from the Judgment of the Hon'ble Supreme Court are reproduced hereunder.

" 413. It needs to be stated that the gravamen of the rival assertions span from wrong application of the principles of equitable apportionment to the facts of the case, defective assessment of the materials on record bearing on the requirements registered by the competing States, faulty approach in the matter of evaluation of the parameters bearing in particular on the crop water requirement, ground water availability and use and unmerited rejection of various projects as testimony of rightful claims to resultant inaccurate allocation of the water of the inter-state river involved. …"

1391.

In view of above, the Tribunal is constrained to take a view that the allocation of entire water of the Mahadayi basin among the three party States would not be appropriate at this stage. This is more so in view of the fact that present level of consumptive use of water resources in Mahadayi basin is relatively very very less. However, the Tribunal is fully aware of

the importance of the development of water resources for meeting the ever-rising needs and aspirations of the people and therefore, the Tribunal has examined all the proposals put forward by the States and taken a view on their suitability or otherwise. The Tribunal, accordingly, has permitted the States to take up specific developmental activities. Further, the Tribunal is of the firm opinion that immediate action is required to be taken in respect of: (a) observation and collection of water resources data including hydro-meteorological and hydrological data in systematic and correct manner, (b) hydrological analysis; (c) studies in respect of environmental issues and likely impact of climate change; and (d) planning for sustainable development of water resources of the Mahadayi basin. The Tribunal therefore expresses the view that all these exercises must be undertaken by the “Mahadayi Water Management Authority” so that dependable information are available

for

equitable

apportionment of water among the party States, which can be

considered after 30 years from now.

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WATER SHARING MECHANISM

1392.

After considering all the relevant facts put up by the party States before the Tribunal, the diversion of (a) a maximum of 1.72 tmc of Mahadayi water corresponding to 75% dependability from proposed diversion point on the Kalasa Nala by the State of Karnataka, (b) a maximum of 2.18 tmc of Mahadayi water corresponding to 75% dependability from proposed diversion point on the Bhandura Nala by the State of Karnataka, and (c) utilization of a maximum of 0.56 tmc of Mahadayi water corresponding to 75% dependability for consumptive uses from proposed Virdi Large Minor Irrigation Project by the State of Maharashtra have been permitted by the Tribunal. The permitted (a) diversion of 1.72 tmc from proposed diversion point on Kalasa Nala, (b) diversion of 2.18 tmc from proposed diversion point on Bhandura Nala, and (c) utilization of 0.56 tmc from proposed Virdi Large Minor Irrigation Project will be inclusive of reservoir losses, etc.

1393.

In the water years when the inflow into the reservoir(s) at the proposed project site are less than that estimated one at 75% dependability, there shall be reduction in

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the quantum of diversion permitted, in order to ensure that reasonable quantum of water flows downstream of the proposed project(s) so that adequate flow for meeting environmental needs is maintained by the project authority.

1394.

The proposed Mahadayi Water Management Authority (NWMA) and / or the Central Water Commission (CWC) will meticulously analyze the available data and develop an appropriate regulation model in consultation with the concerned State Governments.

1395.

The Tribunal has permitted the State of Karnataka and the State of Maharashtra for consumptive uses of water by diversion at specific project sites corresponding to availability at 75% dependability either for in-basin use or uses outside the

basin after taking into consideration the e-flow requirements which is corresponding to the 90% dependability. The Tribunal finds that in case two projects namely, Kalasa-Bhandura Project in Karnataka and Virdi Project in Maharashtra, the respective State Governments have, taken up the construction activities in respect of some components. The Tribunal has accorded permission for various projects subject to fulfilling specific

directions that: (a) the State Governments shall undertake fresh planning and development of scheme for consumptive uses within the basin and / or diversion outside the basin including the reservoir losses etc. for not more than specified quantity; and (b) the proposals in the form of Detailed Project Reports would be considered for implementation only (i) after technical appraisal of the proposed projects by the Central Agencies, and (ii) after obtaining all mandatory clearances as required. In view of the fact that works on some components have already been taken up, the respective State Governments may expedite the process of preparation of revised Detailed Project Reports, their appraisal by Central Agencies and obtaining the mandatory clearances, and take up the works early.

1396.

With a view to ensuring that soon after completion of the aforesaid projects, a reasonable quantum of water flows downstream of the

proposed

project(s)

for

meeting

environmental needs, the Tribunal has examined the flow series generated at the various identified sites and it is found that the quantum of water corresponding to 30% of the 90% dependable flow, varies from about 18% to 25% of the 75% dependable flow. With a view to arriving at a sharing formula to be adopted for

regulation of inflows at the control points, simulation study using flow series has also been carried out. It is found that necessary requirement of e-flow as well as the conditions of success rates in respect of the aforesaid three projects would be met with, by restricting the releases for diversion to 76% of the inflow, into the reservoirs.

1397.

For the purpose of regulation of the diversion of Mahadayi waters, the water year will be considered to start from 1 st June and end on 31 st May. However, the diversion of water will be permitted only during the five months monsoon period i.e., from 1 st June to 31 st October. Even if, some inflows are observed into the reservoir(s) during the non-monsoon period, no diversion is permitted out of the inflow during the non-monsoon period starting from 1 st November to 31 st May.

1398.

Till such time the regulation model is developed in consultation with the concerned State Government(s), following procedure shall be adopted for regulation of flow from the

projects sites.

a. The inflow at the three projects i.e., (i) proposed diversion point on the Kalasa Nala, (ii) proposed diversion point on the Bhandura Nala, and (c) proposed Virdi Large Minor Irrigation Project, would be observed by MWMA or by CWC on daily basis, and proper record of the same should be maintained. In addition, the estimate of the reservoir losses would also be made, by the project authorities and proper record of the same shall be maintained. In case, the concerned State Government proposes to depute its representatives to be present during the measurement of inflow, they shall be allowed to be present and witness the measurements.

b. For each time-step adopted for regulation of the inflows / outflows, the sum total of (i) the diversion from the reservoir, (ii) change in the reservoir storage during the time-step, and (iii) the reservoir losses, shall not be more than 76% of the observed inflow into the reservoir.

c. Proper record of the quantum of diversion on daily basis, shall be maintained. Simultaneously, the record of

cumulative quantum of water diverted from the reservoir with effect from 1 st June shall also be maintained.

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d. As soon as the cumulative quantum of diversion or utilization (including the reservoir losses) equals the permissible limit (1.72 tmc at proposed diversion point on the Kalasa Nala, 2.18 tmc at proposed diversion point on the Bhandura Nala and 0.56 tmc at proposed Virdi Large Minor Irrigation Project), no more diversion of water will be allowed and the gates will be closed and all inflows during non-monsoon period shall be allowed to flow downstream of the project.

RECOMMEDNATIONS MADE BY THE MAHADAYI WATER DISPUTES TRIBUNAL

Data Observation and Data Bank

1399.

As per Section 9A(1), The Central Government has to maintain a data bank and information system at the national level for each river basin, which shall include data regarding water resources, land, agriculture, and matters relating thereto. Further, it stipulates that the State Government shall supply the data to the Central Government or to an agency appointed by

the Central Government for the purpose, as and when required.

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1400.

Section 9A(2) states that the Central Government shall have powers to verify the data supplied by the State Government, and appoint any person or persons for the purpose and take such measures as it may consider necessary. The said Sub-section further postulates that the person or persons so appointed shall have the powers to summon such records and information from the concerned State Government as are considered necessary to discharge their functions under this Section.

1401.

The Tribunal has been informed that Central Water Commission (CWC) is responsible for observation of data in respect of gauge, discharge, sediment and water quality at key Gauging Stations throughout the country. The data so collected are processed and stored by the regional offices of CWC and are made available to the users' agencies after following the prescribed procedures. Further, there is a 'River Data Directorate' at the CWC Headquarters. CWC also brings out

‘Water Year Book’ in respect of hydrolo gical data of basins which are in public domain.

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In addition to collection of hydrological data by CWC from key Gauging Stations, hydrological data are also collected by the Water Resources Departments of the respective State Governments.

1402.

The Tribunal is informed that Central Water Commission and ISRO have jointly developed Web-based India Water Resources Information System, which includes

information related to Basins, River Network, Water Resources Projects, Water Bodies/Reservoirs along with Ground Water Resources data collected by Central Ground Water Board (CGWB), and information in respect of hydro-meteorological data such as rainfall, temperature etc. collected by the India Meteorological Department (IMD).

1403.

This Tribunal notices that consequent upon approval of the Cabinet, National Water Informatics Centre ('NWIC' in short), has recently been created by the Ministry of Water Resources, River Development and Ganga Rejuvenation at New Delhi, vide notification dated 28 th March 2018. NWIC is supposed to be a repository of nation-wide water resources data and would be headed by a Joint Secretary level officer.

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1404.

In this backdrop, National Water Informatics Centre is expected to provide a ‘Single Window’ source of updated data on water resources and allied themes. It is further expected that the said Agency shall also provide value added products and services to all stake holders for its management and sustainable development.

1405.

The experience of Mahadayi Water Disputes Tribunal is that there was no single source for supply of necessary data required for assessment of water availability. On the basis of information provided by the States of Goa, Karnataka and Maharashtra, the position in respect of source of related data is as under.

Observed gauge and discharge data

a. Observed discharge data at Ganjim and Collem Gauging Stations for the period from 1979 to 2012 by Central Water Commission

b. Observed discharge data at Khadki, Daucond, Kudchire and

Paikul for varying period from 2009 to 2013 by the Water

Resources Department of the State of Goa

c. Observed discharge data at Chapoli for the period from 1985 to 1991 and from 2000 to 2013 by the Water Resources Department of the State of Karnataka

d. Observed discharge data at Virdi for the period from 1986 to 2004 and 2006 to 2011 by the Water Resources Department of the State of Maharashtra

Data in respect of rainfall

Rainfall data have been collected by CWC as well as by the State of Goa from IMD. Further, the rainfall data in respect of Rain Gauge Stations maintained by the State of Goa, the State of Karnataka and the State of Maharashtra have also been made available by the respective State Governments.

Data in respect of sedimentation, evaporation, infiltration etc. were neither collected nor made available by any of the party States. Limited information in respect of utilization were made available by the respective State Governments. In respect of basin features, only general information about topography, geological features and soil characteristics etc. were included by the party States in the documents filed by them.

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1406.

On examination of the data provided by the party States, the Tribunal found serious issues relating to variations in the data of same station for the same period reported in documents filed by two States, or reported in two different documents of the same State, particularly in respect of rainfall data. Further, the Tribunal noticed that consistency of the data was a serious issue. It was found by the Tribunal that proper consistency checks were not carried out by any agency which led to varying conclusions about the quality of data.

1407.

The Tribunal noted that none of the party States had undertaken the exercise for external consistency despite the procedure being clearly identified in the “Guidelines for Preparation of Detailed project Reports of the Irrigation and Multipurpose Projects” (MARK -5) and considerable hydro-meteorological and hydrological data from several stations being available. Obviously, the decisions of experts considering the data of certain period of the particular station as ‘not acceptable’

or ‘acceptable after modification’ was not based on thorough examination of all aspects.

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1408.

that

Under the circumstances, the Tribunal recommends

the NWIC must

be charged with the following

responsibilities.

a. All the States of Union of India as well as Union Territories should be directed to adopt a uniform methodology, for collecting data from Hydrological Observation Stations on various rivers or their tributaries.

b. All the States of Union of India as well as Union Territories should be directed to follow the procedure for observation of rainfall data as laid down by IMD in respect of Rain Gauge Stations.

c. All water related data, particularly (i) hydro-meteorological data, (ii) hydrological data, and (iii) water use data being observed by various agencies of the Central Government, State Governments or other Institutions, must be collected, thoroughly checked, processed and stored by the NWIC.

d. The data in respect of water utilization should be comprehensive and must include all information, particularly those in respect of water supply from the sources, the water actually utilized and the losses at different stages.

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e. The data so collected must be checked properly for accuracy and consistency, and only those data, which are found to be: (i) observed as per prescribed procedure; (ii) consistent; and (iii) reliable, should be kept in public domain.

f. The data found to be inconsistent and not observed properly should be referred for further detailed examination to the competent central agency with the objective of identifying the possible sources / causes of errors and rectifying the same and taking corrective measures for future observations including Advisories to the agencies responsible for observations.

Guidelines for Hydrological Analysis for Assessment of Water

Availability and Training for Professionals

1409.

The Tribunal notices that the Union Ministry of Water Resources has issued the “Guidelines for Preparation of Detailed Project Reports of the Irrigation and Multipurpose Projects” which inter- alia includes a chapter on ‘Hydrology’ describing various procedures including that for assessment of water availability.

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1410.

However, the Tribunal found that none of the party States or the Experts who appeared as witnesses before the Tribunal, followed the procedure prescribed in the Guidelines. Most of the Experts considered hydrology as an in-exact science and chose to deviate from the Guidelines issued by the Ministry of Water Resources and adopted approach of their own likings. This has led to considerable variation in the process of assessment of water availability and hence the ultimate results. Some notable variations / contradictions noted by the Tribunal are as under.

a. Length of data used for development of rainfall runoff relation varied from 10 years to 34 years

b. Length of data used for generation of time series of annual yield varied from 25 years to 85 years

c. An expert opined that out of 34 years of observed discharge data at Ganjim by CWC, the data of only 5 years was acceptable. He modified the data of 22 years and ignored the data of 7 years for the purpose of his analysis

on one ground or the other.

d. Another expert opined that the observed discharge data of 34 years observed at Ganjim by CWC was consistent, but at

the same time, he decided to ignore the data of 9 years for the purpose of development of Rainfall-Runoff relations. However, for the purpose of assessment of water availability at a project site, the Expert used the observed data of all the 34 years including those which were ignored by him for development of Rainfall-Runoff relations. The expert also opined that the data observed at Collem by CWC was not consistent and that he decided not to use the data in one of his Reports, but he used the data of Collem for estimation of yield at a proposed project site.

e. Even CWC opined that the data of Ganjim were consistent but the data of 9 out of 20 years were ignored by CWC for the purpose of development of Rainfall-Runoff relation.

f. Various Experts employed different methods for filling-in the missing rainfall data.

g. The Experts chose different methods for estimating the average rainfall – sometimes the Thiessen Polygon Method was used while on other occasions, Arithmetic Mean Method was used.

1411.

The Tribunal notes with concern that despite

availability of considerable data, in respect of rainfall and runoff,

no serious effort was made to examine the data as per the standard procedures included in the Guidelines, take a rational view after considering all aspects and develop an appropriate Rainfall-Runoff model which would represent the flow characteristics that would be useful in decision making process.

1412.

Although the sources of most of data collected by the party States were same i.e., CWC in respect of river flow data at Ganjim and Collem, and IMD in respect of rainfall data at various stations in and around the basin, each of the three States have projected different figures relating to availability of water in Mahadayi Basin with very large variations. The estimated water availability at 75% dependability for the entire Mahadayi basin, which were reported by the party States and the experts, varied from 208.73 tmc to 145.05 tmc. One State would contend that Mahadayi Basin is a surplus basin whereas another State would contend that Mahadayi Basin is a deficient one. The result was that the Mahadayi Water Disputes Tribunal had to struggle a lot to arrive at an acceptable yield of Mahadayi Basin at 75%

dependability, due to which, most of the time of the Tribunal was occupied only in determining the yield of Mahadayi Basin at 75% dependability.

2683

1413.

The situation is undoubtedly very serious. This is more so in view of the fact that the Hydrology Studies Organization of CWC is fully devoted to hydrological analysis and a premier research institute namely, National Institute of Hydrology is in existence since 1978 with main objective of undertaking, aiding, promoting and coordinating systematic and scientific work in all aspects of hydrology. As per the web-site of the National Institute of Hydrology, the Institute is well equipped to carry out computer, laboratory & field oriented studies. Further, the Tribunal is also informed that a Hydrology Project with assistance of the World Bank is being implemented by the Union Ministry of Water Resources since 1995, that the Phase-I and Phase-II of the said project have since been successfully implemented and that the Phase-III of the project is currently under implementation with objectives “ to improve the extent, quality and accessibility of water resources information, and to strengthen the capacity of water resources management institutions in India ” .

1414.

The Tribunal is baffled and also anguished that

despite availability of considerable data, existence of expert

organization and institutions and implementation of specific

2684

projects related to hydrological data, hydrological analysis and capacity building, the Tribunal had to struggle for arriving at an acceptable value of water availability at 75% dependability of the Mahadayi basin.

1415.

Under the circumstances, the Tribunal feels it proper to recommend the Union Ministry of Water Resources, River Development and Ganga Rejuvenation as under.

a. The Union Ministry of Water Resources, River Development and Ganga Rejuvenation should undertake comprehensive and critical review of the existing Guidelines with the objective of identifying the reasons as to why the provisions related to assessment of water availability could not be and cannot be strictly adhered to.

b. The Union Ministry of Water Resources should urgently prepare comprehensive Guidelines and Manuals with the objective of:

i.

introducing standard practices to be used under given

conditions of data availability etc. by all agencies of the Central and State Governments associated with water resources planning and particularly in respect

2685

of planning for water resources of inter-State river basins;

ii.

minimizing the element of personal judgments by the expert; and

iii.

arriving at most rational and acceptable assessment of water availability.

c. As observed earlier, the management of Water Resources and more particularly determining yield of a basin of an inter-State River, is highly complex and tedious task that involves expertise of multi-disciplinary domains etc. Therefore, the engineers, technicians etc. who are involved in determining the yield of a basin of an inter-State River, must be given sufficient training, particularly in the areas of data collection, processing of data, and assessment of water availability of the basin as a whole and at important locations in the basin.

d. Refresher courses must be introduced at national level so

that correct data is collected by the agencies of the Central and State Governments as per the standard practices and is beneficially used in hydrological analysis.

e. The emphasis of the training and refresher courses should be on imparting knowledge to the professionals working in

2686

field formations and responsible for data observation and its analysis.

1416. Union Ministry of Water Resources, River Development and Ganga Rejuvenation should prepare Action Plan to ensure that the provisions of National Water Policy, 2012, are implemented by each State in spirit and letter and that ‘water for life’ i.e. the basic safe water requirements for realization of the fundamental right to life of each human being, including drinking, cooking, bathing, sanitation, personal hygiene and related personal or domestic uses, with requirement of additional human for their especial needs and water

requirement for domestic lives, is made available to each citizen of India.

Suggestions for Reviewing the Provisions of the Inter-State River Water Disputes Act, 1956

1417.

During the course of hearing of the disputes between the State of Goa, the State of Karnataka and the State of Maharashtra, this Tribunal found that there are certain basic lacunae in the provisions of the Inter-State River Water Disputes

Act, 1956 and, therefore, following suggestions are made to the Central Government:

a. The Mechanism, dealing with inter-State water disputes, functions ineffectively because of several reasons. The most prominent problem faced by an inter-State Water Disputes Tribunal is that it does not have any effective authority or power or jurisdiction for the implementation of its Award/ Report/ Final Decision. The Tribunal can only give an Award, but cannot enforce its implementation. Therefore, appropriate amendment should be made in the Inter-State Water Disputes Act, 1956, conferring power and authority upon the Tribunal to implement its Award / Report / Final Decision. If necessary, the powers for punishment for contempt or non-compliance of Award / Report / Final decision must be conferred upon Inter-State Water Disputes Tribunals.

b. This Tribunal finds that before constituting a Water Disputes Tribunal, the Central Government has to form an opinion that the water dispute cannot be settled by

negotiations. It is essential that the legal frame work of the dispute-settlement mechanism should be constantly

strengthened. It is noticed that the water disputes are merely seen as political issues and water management problems. Thus, for solving such disputes, interminable conferences attended by political representatives, bureaucrats and water management engineers, take place and legal aspects get pushed into the background. With legal aspects getting blurred, such conferences hardly lead to any settlement, with the result that the water disputes drag on. The consequent delay in the settlement of water disputes blocks the development of water resources and causes untold miseries to the concerned States and their people. It should be clearly understood that whenever there is an element of rights or interests of several contesting parties, the content of law automatically comes into play and its proper recognition and handling is a must.

Apathy towards the legal aspects is bound to result in unwanted prolongation of the concerned disputes.

c. In order to bring the parties to the Inter-State Water Disputes to the negotiating table, it may be helpful to constitute Joint Commissions or Boards under the River Boards Act, 1956. Such Boards can smoothen the process of negotiation between the contending parties. In case a

Tribunal is set up for settling some inter-State water dispute, the Joint Commissions or Boards can assist the concerned Tribunal also in expediting the dispute-settlement process, by supplying necessary data. Such Commissions and Boards can also be helpful, after the conclusion of the negotiated agreement or the decision of the Tribunal, for the purpose of administering or implementing the agreement or the Award of the Tribunal, as the case may be.

d. A convention should grow in such a way that the Central Government constitutes a Tribunal and refers the concerned dispute to it without any unreasonable or avoidable delay, after the receipt of a complaint in that regard.

e. It has been noticed that there is quite often a long delay in the publication of the decision of the Tribunal. Such delays cause a great deal of inconvenience and hardship to the parties. The present provisions in the concerned Statute are very vague in this regard. Once the Tribunal has

communicated the decision to the Central government and contestant parties, the decision of the Tribunal must be

published in the official Gazette as early as possible so that its implementation is not delayed.

f. On the basis of the provisions of the Water Prevention and Control of Pollution Act, 1974, the River Boards Act, 1956 and the Environment Protection Act, 1986, the Government should create Boards to monitor and prevent environment pollution including, of course, water pollution.

g. Section 4 of the Inter-State Water Disputes Act, 1956, should be amended in such a way and / or manner as to prescribe therein that the States Concerned shall make their utmost endeavor to settle an inter-State water dispute through an Agreement and that such an agreement will be ratified within a specified period of time say three

months. Further, there should be a provision in the said Act that on being ratified, such agreement will be deposited with the Ministry of Water Resources of the Central Government and thereafter the validity and authenticity of such agreement shall not be challengeable by way of amendment. A provision should be made that review of the Decision/Award of the Tribunal after the lapse of reasonable time, say twenty or thirty years, in the light of any substantial change in circumstances, is permissible.

2691

h. It should be specifically mentioned in the Inter-State Water Disputes Act, 1956, somewhere that the term “State Government” includes “Union Territory Government” also so that, the disputes by or with the Union Territories also could come within the purview of the said Act.

Participation of Union Government in the proceedings of the Tribunals

1418.

The para 1.3 of the National Water Policy, 2012, inter-alia states as under.

“ 1.3 Public policies on water resources need to be governed by certain basic principles, so that there is some commonality in approaches in dealing with planning, development and management of water resources. These basic principles are:

(i) Planning, development and management of water resources need to be governed by common integrated perspective considering local, regional, State and national context, having an environmentally sound

basis, keeping in view the human, social and economic needs.

(ii) Principle of equity and social justice must inform use and allocation of water.

(iii) Good governance through transparent informed decision making is crucial to the objectives of equity,

social justice and sustainability. Meaningful intensive participation, transparency and accountability should guide decision making and regulation of water resources.

…"

In view of the above, the Union Government has to play an important role in planning and management of water resources of the country, particularly in respect of (a) collection of necessary data / information, (b) independent examination of facts and needed studies, (c) research and training, (d) evaluation of proposals formulated by the States, and (e) monitoring of projects, etc. The role of the Union Government becomes vital in respect of inter-State River Basins.

The experience of this Tribunal is that data and studies of the Central Agencies and Guidelines / Manuals etc. prepared by the Union Government were very often referred to by the party States with varying interpretations. On many occasions, clarifications were needed to have true interpretations of the data / information and provisions of the Guidelines / Manuals

etc. Therefore, this Tribunal is of the opinion that the presence of a representative of the Union Government during the proceedings before the Tribunal(s) will help considerably in

2693

timely disposal of the issues and arriving at the most rational decisions. Further, another very important aspect relates to concerns of the Union Government in specific matters, like, priority of uses, particularly when the States have varying priorities which are different from what emerges from the National Water Policy.

In view of above, it is recommended that the Union Government should also be represented appropriately during the proceedings of the Tribunal.

AWARD AND FINAL DECISION OF THE TRIBUNAL

1419.

In view and on the basis of the discussions held and the findings recorded on the issues hereinbefore, the following order is passed.

Clause-I

The river Mahadayi or river Mandovi or river Madei or river Mhadei is one and the same river system, specific name being used in a particular region, and river Mahadayi or Mahadayi river

basin, referred to in this Order is for the entire river and river system.

Clause-II

The Mahadayi river basin drains an area of 2032 sq.km., out of which an area of 375 sq.km. lies in the State of Karnataka, 77 sq.km. in the State of Maharashtra and rest in the State of Goa.

Clause-III

For the purposes of this case, the water availability of the entire Mahadayi river basin (inclusive of all tributaries) with total catchment area of 2032 sq.km. i.e., runoff generated over the catchment area of 2032 sq.km. of Mahadayi river basin at 75% dependability is determined as 2621.8 Mcum (188.06 tmc). The water availability determined herein does not include the import of water to Mahadayi river basin from Tillari (Chapora) river through Tillari Irrigation Project.

Clause-IV

For the purposes of this case, the water availability of the catchment area of the Mahadayi river including the tributaries of the Mahadayi river in the territory of the State of Karnataka (for

the catchment area of 375 sq.km.) at 75% dependability is determined as 909.8 Mcum (32.11 tmc).

Clause-V

For the purposes of this case, the water availability of the catchment area of the tributaries of the Mahadayi river in the territory of the State of Maharashtra (for the catchment area of 77 sq.km.) at 75% dependability is determined as 204.2 Mcum (7.21 tmc).

Clause-VI

Having noted the facts that:

(a) the present level of utilization of waters of Mahadayi river basin is not more than 5% of the water availability at 75% dependability;

(b) the projection of the future requirements of waters of Mahadayi river basin by the respective party States for various purposes in the States is not fully justified as the projections are (i) not based on adequate and consistent data / information, (ii) not based on scientific research and studies, (iii) without proper evaluation and

consideration

of

social,

economic

and

ecological

2696

considerations,

and

(iv)

without

examining

the

sustainability of the resource; and

(c) all the requisite data and information required for evaluation of the demands of the three States for equitable apportionment in light of various criteria, particularly those mentioned in either the Helsinki Rules or the Water Resources Law of International Law Association, Berlin Conference, 2004, are not provided by the respective States in their respective Cases / Claims; the Tribunal finds that equitable apportionment of Mahadayi waters amongst the party States is neither necessary nor feasible at this stage.

Clause-VII

The Tribunal is of the firm view and hence decides that in the

absence of any apportionment of water amongst the party States, the activities related to water resources development for the benefit of the society must not stop and people of the party State must not suffer. Therefore, the Tribunal, after examination of the various proposals submitted by the States and keeping in view all available information and particularly from the view point of (a) sustainability of the resource, and (b) ecological

needs, permits the States to undertake specific activities as stated in Clause-VIII.

Clause-VIII

The three party States viz. Karnataka, Maharashtra and Goa, are permitted to undertake specific water resources development activities in the Mahadayi river basin as under.

A. KARNATAKA

i.

The demand of the State of Karnataka for 42.5 Mcum (1.5 tmc) of water for in-basin consumptive use for drinking water and irrigation within the Mahadayi river basin, along with evaporation losses from the reservoir(s) through proposed Mahadayi Hydro-Electric Project (MHEP) is considered as reasonable and is hereby granted by the Tribunal.

ii.

Keeping in view the overall scenario related to water availability, water needs, water demands, essential requirements towards environmental flow, etc., the State

of Karnataka is also permitted to divert 61.8 Mcum (2.18 tmc) of Mahadayi water at proposed Bhandura dam and

48.7 Mcum (1.72 tmc) of water at proposed Kalasa dam, only subject to fulfilling the following directions:

a. The State of Karnataka shall undertake fresh planning and development of schemes for consumptive uses within the basin and / or diversion of water outside the basin, including the reservoir losses, etc., for not more than 61.8 Mcum (2.18 tmc) at the proposed Bhandura dam site; and

b. The State of Karnataka shall undertake fresh planning and development of scheme for consumptive uses within the basin and / or diversion of water outside the basin including the reservoir losses etc. for not more than 48.7 Mcum (1.72 tmc) at the proposed Kalasa dam site.

c. Such utilizations shall necessarily require thorough review and modification of the Detailed Project Reports by the State Government of Karnataka. The State of Karnataka shall prepare modified Detailed Project Reports (DPRs) for diversion of water from the Mahadayi

river basin.

d. The proposals in the form of Detailed Project Reports would be considered for implementation only after

technical appraisal of the proposed projects by the central agencies, and only after obtaining all mandatory clearances as required by law.

iii.

The State of Karnataka is permitted to develop the Mahadayi Hydro Electric Power Project at Kotni for hydropower generation, a non-consumptive use, in addition to the aforementioned consumptive use of 42.5 Mcum (1.5 tmc) of water within the basin for drinking water, irrigation, etc. However, the State of Karnataka shall modify the Detailed Project Report (DPR) of the proposed Mahadayi Hydro Electric Power Project adopting the water availability at 75% dependability at the proposed project site limiting to a maximum of 227.4 Mcum (8.02 tmc) i.e., the water availability at 75% dependability assessed by the Tribunal (from the catchment area of 93.19 sq.km. i.e., without the Bhandura catchment of 32.25 sq.km.) only. The State of Karnataka is directed in clear terms that such utilizations would be permissible only after thorough

review and modification of the Detailed Project Reports and that the proposals in the form of Detailed Project Reports would be considered for implementation only: (a) after technical appraisal of the proposed projects by the

Central Agencies; and (b) after obtaining all mandatory clearances as required by law. Until such exercises are completed, no amount of water shall be actually utilized by the State of Karnataka at the proposed Mahadayi Hydro Electric Power Project at Kotni.

iv.

The demand of the State of Karnataka for diversion of 156.6 Mcum (5.527 tmc) of water of Mahadayi river basin to the Supa reservoir of the Kali Hydro-Electric Power Project, for generation of hydro-power is not found justified by the Tribunal, and is therefore, rejected.

v.

The demand of the State of Karnataka in respect of proposed diversion of 198.3 Mcum (7 tmc) of surplus water from the proposed Kotni reservoir of the Mahadayi Hydro Electric Power (MHEP) Project, has also not been found justified and is hereby rejected by the Tribunal.

B. MAHARASHTRA

i.

The Tribunal permits the State of Maharashtra limiting to 15.93 Mcum (0.56 tmc) of water for Virdi Large MI Project, which shall include all consumptive uses including reservoir losses, subject to the condition that the State of Maharashtra shall revise the project features and prepare a modified detailed project report (DPR) to utilize a maximum

of 15.93 Mcum (0.56 tmc) of water for various purposes within the basin.

ii.

The Tribunal also permits the State of Maharashtra to use a total of 21.8 Mcum (0.77 tmc) of water in respect of four proposed projects, viz., (a) 0.32 tmc for (Morachi Rai) Minor Irrigation Project, (b) 0.16 tmc for Virdi B Minor Irrigation Project, (c) 0.27 tmc for Dhangarwadi Minor Irrigation Project, and (d) 0.02 tmc for Ambadgaon Minor Irrigation Project.

iii.

The aforesaid projects shall require thorough review and modification of the Detailed Project Reports by the State Government of Maharashtra before implementation and shall be undertaken only (a) after technical appraisal of the proposed projects by the Central Agencies; and (b) after obtaining all mandatory clearances as required, by law.

iv.

In all, the State of Maharashtra is permitted to utilize 37.73

Mcum (1.33 tmc) of Mahadayi water which will be inclusive of all consumptive uses including reservoir and other losses. Rest of the claims of the State of Maharashtra are not found justified and are hereby rejected.

2702

C. GOA

i.

The Tribunal finds that the profile of the identified 59 project sites, presented through Detailed Project Reports by the State of Goa (although these reports cannot be considered as the “ Detailed Project R eports”), particularly in respect of availability of water at each of the project sites, availability of utilizable water, etc., and the projected utilization of water for various purposes, are not based on requisite field investigations and studies. But, the identification of 59 water resources development project sites by the State of Goa, is a step in the positive direction. In the absence of any other reliable action plan, the Tribunal permits the State of Goa to go ahead with: (a) undertaking proper investigations and studies;

(b)

preparing the detailed project reports (DPRs); (c) seeking clearances from central agencies; and (d) obtaining all mandatory clearances from the competent authorities for a maximum consumptive utilization (including drinking water requirements for both human beings and livestock, municipal water needs, irrigation water requirements and industrial water demands) of 668 Mcum (24 tmc) of water of Mahadayi river basin at 75% dependability through

aforementioned 59 identified projects. The Tribunal does not put any restriction on non-consumptive use of water of Mahadayi river basin by the State of Goa.

ii.

The permission of the Tribunal to the State of Goa to plan for utilization of 668 Mcum (24 tmc) of water at 75% dependability, is over and above the existing utilization of 9.395 tmc by the State of Goa.

iii.

The State of Goa is permitted to plan and utilize a maximum of 24 tmc of water at 75% dependability, as in-basin needs subject to following conditions:

a. Availability of water at 75% dependability and the utilizable water at each of the aforementioned sites shall be assessed after duly accounting for the environmental flow in accordance with “Standard Terms of Reference (TOR) for EIA / EMP Report for Projects / Activities Requiring Environment Clearance under EIA Notification 2006” of the Ministry of Environment,

Forest and Climate Change published in April 2015;

b. Technical appraisal of the detailed project report (DPR) of each of the aforementioned 59 projects shall be conducted by the Central Agencies; and

c. Mandatory clearances for each of the aforementioned 59 projects by the competent authorities.

Clause-X

The Order passed by this Tribunal on 17.4.2014, while disposing I.A. No. 1 of 2012 filed by the State of Goa, will continue to be operative and will stand vacated and / or revoked only after:

i.

The State of Karnataka prepares revised Detailed Project Report (DPR) for consumptive uses within the basin and / or diversion of water outside the basin including the reservoir losses etc. for not more than 1.72 tmc at the proposed Kalasa dam site as permitted under Clause IX;

ii.

The revised DPR of Diversion Scheme at Kalasa Dam site is appraised by the Central Agencies and is duly cleared;

iii.

iv.

All mandatory clearances are obtained as per law; and

The State of Karnataka is allowed to take up works as per

duly approved revised DPR either by the Mahadayi Water Management Authority or the Union Government.

Clause-XI

The Order passed by this Tribunal on 11.2.2015, while disposing I.A. No. 28 of 2012 filed by the State of Goa, will continue to be operative and will stand vacated and / or revoked only after:

2705

i.

The State of Maharashtra prepares revised Detailed Project Report (DPR) of Virdi Large MI Project, limiting to consumptive use of 0.56 tmc of water including reservoir losses etc. as permitted under Clause IX;

ii.

The revised DPR of Virdi Large MI Project is appraised by the Central Agencies and is duly cleared;

iii.

iv.

All mandatory clearances are obtained as per law; and

The State of Maharashtra is allowed to take up works as per duly approved revised DPR either by the Mahadayi Water Management Authority or the Union Government.

Clause-XII

The Central Government shall constitute an Authority, called 'Mahadayi Water Management Authority' to implement the Report and final decision of Mahadayi Water Disputes Tribunal with functions and compositions etc. as mentioned at para 1350

to para 1369 of this Report.

Clause-XIII

At any time after 31 st August 2048, the Award / Final Decision may be reviewed or revised by a Competent Authority or Tribunal, but such review or revision shall not as far as possible

disturb any utilization that may have been undertaken by any State within the limits of allocation made to it.

Clause-XIV

The Governments of Goa, Karnataka and Maharashtra shall bear their own costs for appearing before the Tribunal. The expenditure of the Tribunal shall be borne and paid by the aforesaid three States in equal shares.

Clause-XV

Nothing contained herein shall prevent the alteration, amendment or modification of all or any of the Clauses by agreement between the Parties.

Clause-XVI

This Award / Final Decision of the Tribunal shall come into

operation on the date of publication in the Official Gazette as required by Section 6 of the Inter-State River Water Dispute Act, 1956.

ACKNOWLEDGEMENT

The Tribunal has completed its task of preparation of the Report-cum-final-decision after completing the hearing of the

reference made to the Tribunal by Central Government. This was indeed a very difficult task, but fortunately the Tribunal has been able to complete the same without any hassle and also before the stipulated time which is 20-08-2018. The Tribunal has received help, assistance and support from many quarters and therefore, the Tribunal would like to acknowledge the same with thanks.

The Tribunal deeply appreciates the assistance and help of Shri Fali S. Nariman, Shri Ashok Desai, Late Shri Anil B. Divan, Shri Shyam Divan, Late Shri T.R. Andhyarujina, Shri Atmaram N.S. Nadkarani, Shri S.S. Javali, Shri P.S. Narasimha, Shri Madhusudan R. Naik, Advocate General for the State of Karnataka, Shri Mahesh Sonak, learned Senior Counsel, Shri Ravi Varma Kumar, former Advocate General for the State of Karnataka, Shri S. Vijay Shankar, former Advocate General for the State of Karnataka, Shri Dattaprasad Lawande, Advocate General for State of Goa, Smt. A. Subhashini, Shri P. Venugopal, Smt. Purna Bhandari, Shri Santosh Salvador Rebello, Smt. Nikita Nadkarni, Shri Amogh Prabhu Desai, Smt. Sneha Tendulkar, learned Advocates for the

State of Goa, Shri Mohan V. Katarki, Shri Brijesh Kalappa, Shri Maruti B. Zirali, Smt. Anitha Shenoy, Shri Ranvir Singh, Shri Nishant Patil, Shri Kashi Vishweshwar, learned Advocates for

State of Karnataka, and Shri D.M. Nargolkar, Shri Vijay Kadam, learned Advocates for State of Maharashtra who have very admirably conducted the matter for the State of Goa, Karnataka and Maharashtra with their able and persuasive advocacy. The Tribunal also acknowledges the assistance provided by all the Associate Advocates who all have worked with full dedication and have rendered assistance not only to their Seniors and Leading Counsel but also to the Tribunal.

The Tribunal appreciates the assistance rendered by Shri M.E. Haque, and Shri S.P. Kakran, the two learned Assessors, in assisting the Tribunal to understand the intricacies of some of the technical issues and also in explaining the Tribunal about the technical part of the Report as well as for assistance rendered in preparation of Award. The Tribunal sincerely extends its thanks and gratefulness to both of them.

Shri S.K. Sengupta, former Assessor and Shri Ravinder Singh, former Executive Engineer have also made useful contribution during the site visits and at the hearings of the matter before the Tribunal and the Tribunal acknowledges the same.

Shri Sunil Kumar Sinha, Executive Engineer of the Tribunal was also of immense help and particularly at the time of preparing calculations relating to the several aspects before

finalizing the Report. The Tribunal hereby acknowledges the services rendered by him to the Tribunal.

Shri M.R. Kondle, Registrar of the Tribunal and Shri Suraj Prakash, Assistant Registrar of the Tribunal, have rendered a great help in arranging the 350 Volumes presented before the Tribunal by the three party States as well as in editing major portion of the Report-cum-Decision. They were also responsible for co-ordinating the duties of the Stenographers etc. due to which the Report/final decision could be timely completed. Further, Shri M.R. Kondle and Suraj Prakash have been successful in creating a congenial atmosphere in the Tribunal due to which the whole staff of the Tribunal worked in harmony with each other. The Tribunal is thankful to them for yeoman services rendered to the Tribunal.

The Tribunal also acknowledges the services rendered by Shri Jagdish Chander, former Registrar, Shri K.M. Kapur, former Assistant Registrar, Shri B.V. Sharma, former Registrar (Additional Charge), in establishing and smooth running of the Tribunal and for making nice arrangements for recording of evidence.

The Tribunal also thanks Shri Vijay Kumar Nigam, Shri Sohan Lal Arya, Shri N.V. Pillai, Principal Private Secretaries to the Chairman and Members, Shri Madan Pal, Shri Mohan Lal, Court

2710

Masters, Smt. Rita Budhraja, Shri

Vimal Jaitely, Private

Secretaries to the Assessors, to whom lengthy dictations were given by the Chairman and two other Members of the Tribunal. They had not only taken the lengthy dictation given by the Chairman and two Members but had also obtained transcript of the same immediately due to which the Tribunal has been able to prepare the Report-cum-decision within the stipulated time. For the services rendered by them, the Tribunal expresses its sense of gratitude to them. The Tribunal also thanks Ms. Yashoda Sharma, Ms. Mamta Sharma and the other staff members of the Tribunal for their contribution and support in preparing the Report.

The Tribunal further acknowledges the services rendered by Smt. Subhashini Thaper, Shri C.P. Mehta, former Court Masters who were of great help to the Tribunal while the evidence was being recorded and interim application filed by the State of Karnataka was being heard.

Similarly the Tribunal acknowledges the services rendered

by the Shri V.K. Sharma, Senior Joint Commissioner, Ministry of Water Resources, River Development and Ganga Rejuvenation, for his assistance provided at all the time, during pendency of the matter.

The Tribunal must record that without the co-operation and assistance of the entire team in the Office of the Tribunal, it would not have been possible for the Tribunal to prepare the Report-cum-Decision and submit the same before the stipulated time. The Tribunal records its deep appreciation to all concerned and thank them all for their effective rendition of services and assistance.

J.M. Panchal J.

CHAIRMAN

Viney Mittal J.

MEMBER

P.S. Narayana J.

MEMBER

New Delhi

Dated: August 14, 2018

MAHADAYI WATER DISPUTES TRIBUNAL

THE REPORT-CUM-DECISION

OF

THE MAHADAYI WATER DISPUTES TRIBUNAL

(Under Section 5(2) of The Inter-State River Water Disputes Act, 1956)

IN THE MATTER OF

REFERENCE NO. 1 OF 2011 RELATING TO WATER DISPUTES

OF THE INTER-STATE RIVER MAHADAYI AND THE RIVER

VALLEY THEREOF

BETWEEN

THE STATE OF GOA

AND

THE STATE OF KARNATAKA

AND

THE STATE OF MAHARASHTRA

ORDER

After the submission of our Report-cum-Final Decision dated

14.08.2018, we have found that there is a clerical/arithmetical

mistake in Clause III at page 2694 of Volume XII. Accordingly, while exercising our suo-moto powers, we order the correction of the said clerical/arithmetical mistake and direct that the words "2621.8 Mcum (188.06 tmc)" in Clause III on the aforesaid page 2694 of the Report - cum- Final Decision of the Tribunal, may be read as "2621.8 mm i.e., 5327.5 Mcum (188.06 tmc)".

This Order shall form a part of our Report-cum-Final Decision dated 14.08.2018 submitted to the Central Government. This Order be brought to the notice of all concerned.

Sd/-

J.M. Panchal J.

CHAIRMAN

Sd/-

Viney Mittal J.

MEMBER

Sd/-

P.S. Narayana J.

MEMBER

New Delhi

Dated: August 16, 2018